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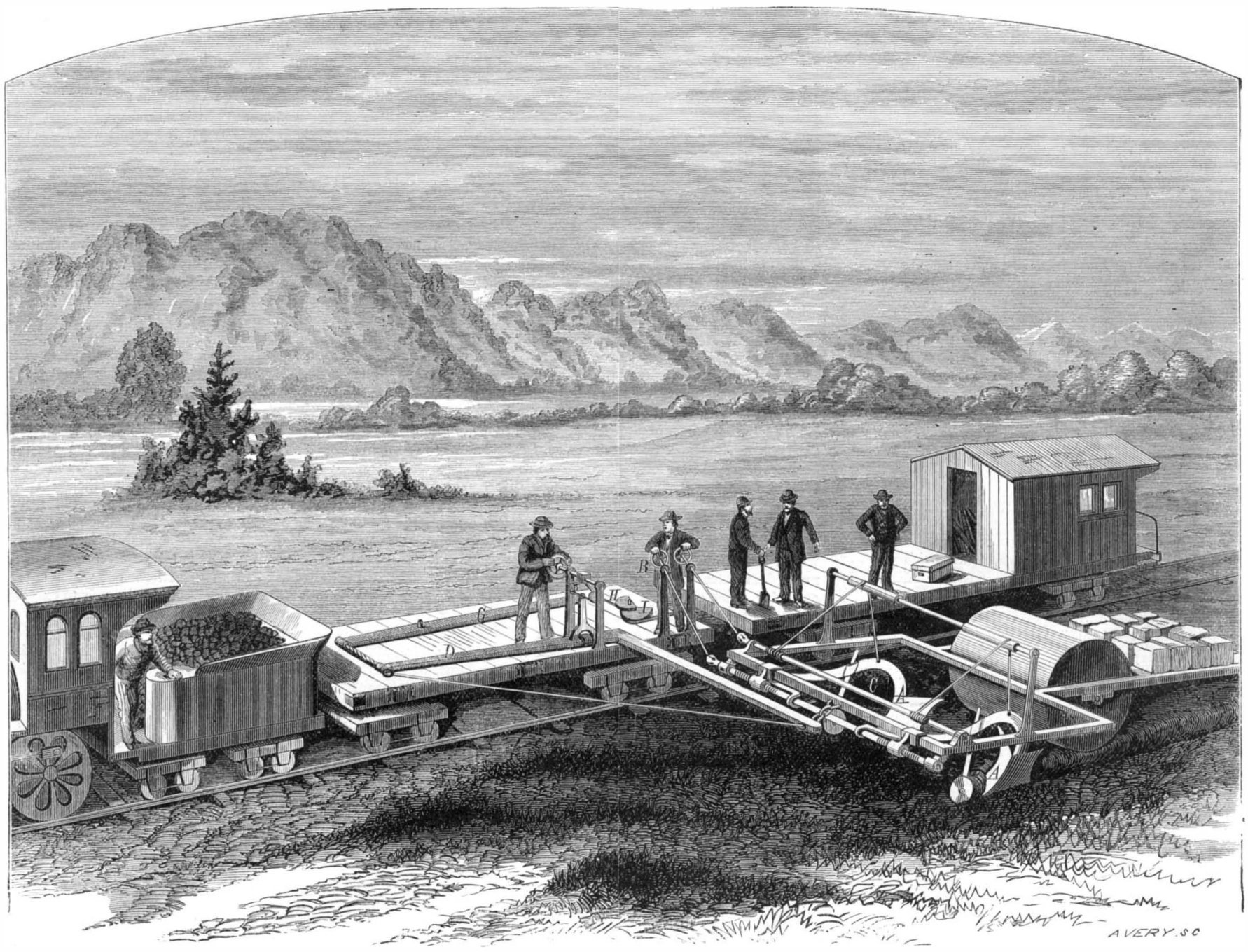

HARDEN'S RAILROAD GRADER.

IMPROVED RAILROAD GRADER.

The accompanying engravings represent a novel device for expeditiously grading railroads. It is mainly intended for use on Western prairies and watersheds, and will, it is claimed, promote the construction and extension of railways by rendering the same less costly, thus aiding in the development of regions now unopened to commerce.

In using the invention, it is first necessary to lay a temporary track over the designated line, to accommodate a locomotive, one platform car, and a caboose, the latter serving as quarters for the workmen and also playing a part in the operation of the device, as will be described further on. The appearance of the grader at work is represented in Fig. 1, and in Fig. 2 are given details of two important portions. Two plows, A, respectively right and left handed, are secured to curved beams which are attached to sleeves moving on the front bar of the heavy rectangular iron frame. Said sleeves are connected to nuts which travel on horizontal screws, placed in bearings on the same bar. By operating this screw (the threads of which are in reverse directions) through the wheel, B, on the platform car—the shaft of said wheel being attached to the screw by a universal joint—the plows can be moved nearer together or further apart. Arms connected to the plow beams pass around the middle portion of the screw shaft and serve to steady the plows. Above and near the front portion of the frame is another shaft, C, also rotated in similar manner by a wheel on the platform car. Chains or cords attached to this shaft lead over a roller and are fastened to the plows. By this means, by revolving the shaft, C, in either direction, the plows may be raised or lowered to cut shallower or deeper furrows as desired. To the rear of the rectangular frame is attached another and smaller frame,

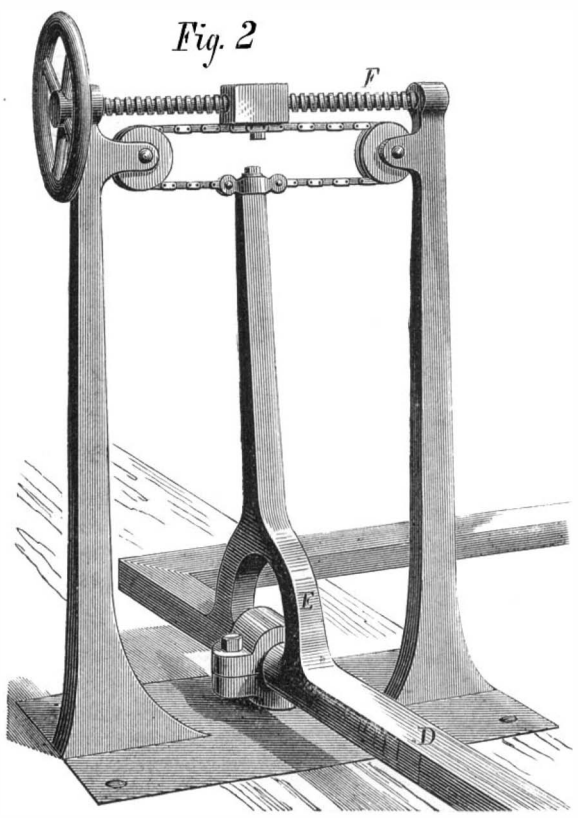

Fig. 2

in which works a large roller. In rear of the latter is a platform which is weighted heavily or lightly, as desired. This is all there is of the machine proper.

The plows, of course, turn furrows in opposite directions, throwing the earth inwards, and making a bed of the necessary width. The loose soil is then leveled by the weighted roller. The grader is drawn by the locomotive, and upon the platform car other devices are arranged, the uses of which we shall next explain. D is a heavy bar, one part of which lies lengthwise of the deck of the car, and the other part, extending out at right angles, forms the point of attachment of the machine. Between the ends of arms a strong brace is fastened. The apparatus, which is represented as being operated by the workman on the car, is shown in detail in Fig. 2, and its use is to lift the whole grader out of action while traveling, or so that obstructions may be avoided. Formed upon the arm of the bar, D, which lies parallel to the axis of the car, is a crotch, E, Fig. 2, between the arms of which the bar is rounded and the cylindrical portion is received in a bearing as shown. Said bearing is pivoted below so that it does not prevent lateral motion of the bar. Above the crotch a single arm extends upward, to each side of the summit of which are attached the ends of a chain, which passes over pulleys journaled in the two standards shown. Also attached to the chain is a nut, which travels on the screw shaft, F. ' It is evident that, when the latter is rotated by the hand wheel, the crotch arm serves as a lever to turn the bar in its bearing, and thus to raise and lower the forward portion of the machine. A device, H, Fig. 1, is used for equalizing the draft. As already stated, the direct arm of bar, D, is pivoted at the base of the bear-

[*Continued on page* 228.]

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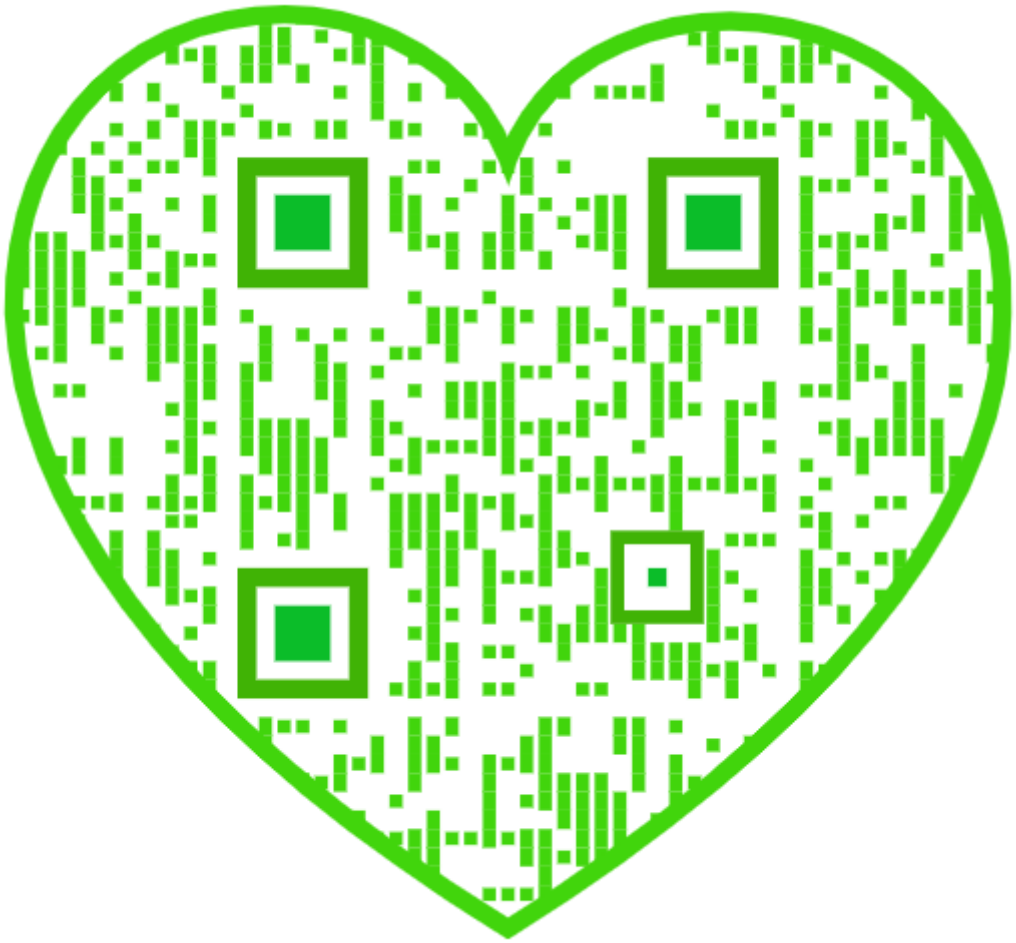

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NEW YORK, SATURDAY, APRIL 14, 1877.

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Dr. L. A. Sayre's method for the Safe Administration of Chloroform.—Croton Chloral for Whooping Cough.—Microscopical Researches on the Hair, by Professor VON EBNER.—Cure for Sea Sickness, by T. SKINNER, M.D.

THE PROPERTIES OF LIGHT AND COLOR.

The idea that anything can be added to light by passing it through colored transparent substances, or by reflecting it from colored surfaces, is utterly erroneous, and proceeds simply from ignorance of the nature of light. It has been proved by Isaac Newton, and since his time by innumerable experiments of various kinds, that pure white light, such as comes from the sun to us, contains all the colors, as well as heat and chemical activity, and that they may be separated, or the light analyzed, by simply passing it through a prism of a transparent substance. The possibility of such a separation has been understood only since the adoption of the vibratory theory, which also explains the nature of the caloric, luminous, colored, and chemical rays. According to this theory, the vibrations, when at comparatively low velocity, manifest themselves as heat only; when the vibrations are rapid enough to produce four hundred and fifty billion waves per second, they become visible as red light. Five hundred billions produce the sensation of orange, five hundred and fifty billions that of yellow, and so on through green, blue, and violet, the latter resulting from eight hundred and fifty billions of vibrations per second. Vibrations still more rapid are invisible to the human eye, but their existence is demonstrated by their chemical action, in the same way as the invisible vibrations below four hundred and fifty billions per second manifest themselves as heat only.

Densely transparent media retard the light, and this retardation will affect the rapid vibrations more than those of slower velocity; and under certain circumstances such media will cause light to be deflected from its course in such a way that the most rapid vibrations will be most deflected and the slowest least. This is the principle of refraction, by which light can be separated into its caloric, chemical, and luminous rays of different colors. The refraction of light, permitting the examination of the colors into which it has been split up, is the fundamental principle of the spectroscope, by which the nature of various luminous and illuminated substances can be determined.

The apparent colors of objects are caused by their reflecting rays of vibrations of certain velocities, and neither reflecting nor absorbing others; and the hues of transparent colored objects are similarly produced. They pass only certain rays, and absorb the others; and the reflected or transmitted color is then called the color of the object. In order to perceive such a hue, it is essential that the light by which it is illuminated contains that color; and this is directly demonstrable by illuminating objects with light of one color, when objects of all other colors will appear black or gray. Such a light can, for instance, be produced by burning alcohol in which common salt has been mixed; this produces a pure yellow flame, and objects of whatever color, when seen by daylight, if illuminated by such a flame, will only show this color. Human faces, for instance, have in this light a ghastly, death-like appearance.

An ordinary gas, lamp, or candle light is not a pure white, being deficient in blue rays, and has an excess of red, orange, and yellow; a white object cannot, by such a light, be distinguished from a yellow one; light blue cannot be distinguished from green, and dark blue looks almost black.

In regard to the nature of colored objects, whether painted or dyed, and of transparent media, such as colored glass or liquid solutions, the analysis of their colors by means of the spectroscope shows that what we call simple colors are in most cases complex. Only those colors are pure and simple which we obtain by the prismatic refraction, namely, the spectroscopic colors. The blue cobalt glass, for instance, which is now called mazarin glass, is proved by the spectroscope not to owe its violet shade to the very refrangible and chemically active violet rays at the extreme end of the prismatic spectrum; but on the contrary, this part of the spectrum is totally absent from light passed through blue glass. The special shade of the mazarin glass is caused by the fact that its blue is tempered by a considerable quantity of the less refrangible red rays at the other or caloric extremity of the spectrum, and even with a trace of orange. Its blue is, therefore, of less chemical activity than the prismatic blue, and of course in all its functions, such as heat, chemical action, etc., is far below the original unchanged solar light.

We have gone into the details of these rather elementary matters for the purpose of exposing the ignorance of those who ascribe to the glass a special chemical or curative influence. Some photographers have used blue glass long ago, in order to moderate the intensity of the light for the eyes of the sitter, without robbing it of too much of its chemical activity; and those photographers who possess common sense or experience know that, far from adding to the effect of the light, the blue glass is an impediment, and the necessary time of exposure is rather extended by its use than otherwise. It is strange that such errors can prevail for years, when a simple experiment can settle the matter. All that is necessary is to photograph the solar spectrum, to do the same with a surface painted with a number of various colored pigments, and also to expose a sensitized surface under a series of colored strips of glass. The writer of this article did this more than thirty ago by the Daguerrean process, and satisfied himself about the following points: 1. The chemical effect of the prismatic spectrum extends, for iodide of silver, from beyond the violet to the blue. 2. When bromine is used in connection with the iodine, it extends to within the green, while the yellow and red rays appear to have no effect on silver compounds, but may possess it for other substances. 3. In photographing pigments there is the utmost diversity in the results, according to the nature of the pigment: much greater than the differences in shade would lead us to expect. As a general thing, the pure reds, orange, and yellow, such as are produced by vermilion and chromates of lead, are photographically inert, and give blacks. The blues are the most active, most of all being being ultramarine, next the violet lakes. But even the red carmine takes well, as it has a violet shade; but among the blues, those bordering on green take least, and hence foliage tends to give dark effects, which are only slightly corrected by using bromine. 4. In using as negatives strips of colored glass to print in sunlight, much depends on the shade and intensity of the color. In general, the chemical effect follows the prismatic series from red to blue; but the most effective blue glass is always found to be far inferior to the sunlight alone, pure and simple. And this fact is sufficient to settle the question about the special virtues claimed for blue glass: it cannot possibly have any not already possessed by sunlight. However, if people are induced by its pretended curative properties to take sun baths, which they otherwise might neglect, they may be often benefited by the salubrious influence of the radiation of the mighty orb, an influence which cannot sufficiently be appreciated; but the blue glass would probably get the credit which exclusively belongs to glorious old Sol.

THE AMERICAN EXHIBIT AT THE COMING PARIS EXPOSITION.

Thirteen months now remain between the present time and the opening day of the French International Exposition. We believe that our manufacturers, from their experience at the Centennial, and at previous world's fairs, fully appreciate the value of these exhibitions as advertising mediums; and therefore it is unnecessary for us to dwell upon their advantages in that direction. The prominent consideration now relates to speedy preparations of exhibits; and as the intervening time is short, and a large amount of work must needs be done, those who propose to contribute should realize the fact that there is no time for delay. Our people have a proclivity for leaving things to the last moment, and then doing prodigies of execution. While perhaps many individual displays are thus produced, fully as good as they might have been had more time been taken to their elaboration, still, collectively, a nation's exhibit organized in a hurry is apt to be but a poor show. The American display at Vienna is an example directly in point; and it is certainly to be hoped that the country will not be misrepresented in Paris after a similar fashion. The matter is one which appeals to every manufacturer or inventor who intends to exhibit, and to him individually. It relates to work which every exhibitor should see to himself, and not wait in the expectation that the government is going to boost him into the show by paying for his transportation, or otherwise misdevoting the people's money to his benefit.

There is much being said about the necessity of a large appropriation from Congress, and the organization of a cumbrous body of officials to secure a suitable exhibit from this country. We need neither. The gentlemen who prepared their display at our Centennial can do it again, and need no official help. Our diplomatic officers in Paris should be able to look after the interests of American exhibitors there; and the organization of the national contribution, so far as it may be found conducive to timely despatch and compliance with the regulations of the Exposition officials, may be done on this side of the ocean. There is no need of any appropriation, save the small sum requisite for the purposes above specified. It is an agreeable assumption, doubtless, that our manufacturers are actuated by high patriotic motives in sending their productions across the Atlantic, and that consequently such self-abnegation should be fostered and rewarded. But, unfortunately, such is wide of the fact. Those who contribute do so because they believe that, directly or indirectly, they are going to gain by it; and therefore, if the people are to pay under such conditions, it is just as sensible for Congress to pass a bill for the liquidation of the expenses incurred by manufacturers for advertising in this journal, or in any of the other mediums which they select for informing the public as to their business. The mistake—too commonly made—is that, because foreign governments appropriate large sums and appoint commissions headed by high dignitaries, this country must follow their example. The distinction is ignored that, in the old world, the paternal government acts for the people, and that the government orders that such a display be gathered, and pays for it all of its own motion. Here the people are the rulers; and if any display is made, it is done by the people for their own benefit. It is for the people to say what part they will take in the Exposition, and to act thereon; and therefore for our contemporaries to spur the government on in the matter, as if the people's servants were absolutely in control of the people's actions, is both contrary to the spirit of our institutions and radically absurd.

It is urged that, because France made a good show at our Centennial, international comity requires that we should make as fine a display at her Exposition. Let those who hold this view, then, see that such an exhibit as they will be proud of is made, and let them pay for it. If money is necessary to help inventors who have not the means to forward their productions—and that is the least objectionable use to which pecuniary assistance can be devoted—let it be raised by popular subscription. A display thus prepared will be more truly representative than any other which could be gathered; and every subscriber will have a direct personal interest in its excellence.

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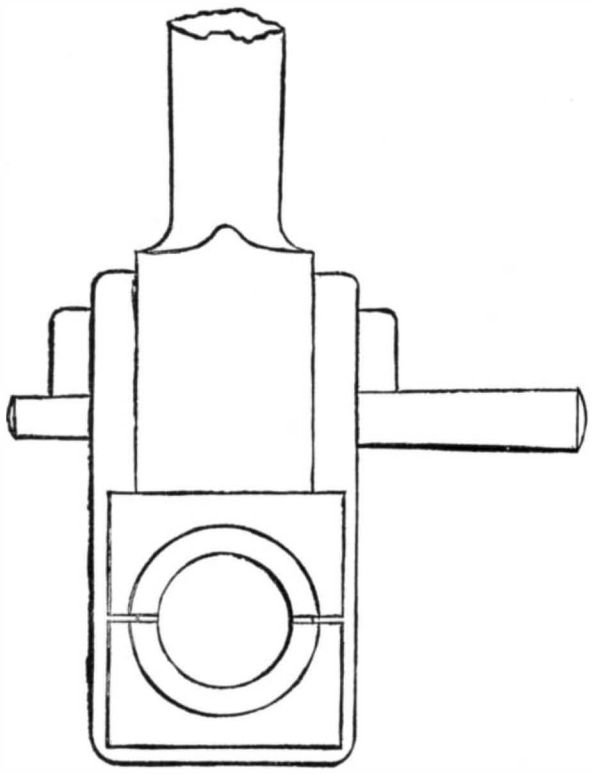
ADJUSTING CONNECTING ROD BRASSES.

P. D. H. says: "I inclose you a drawing of the connecting rod end, to connect with the crank pin on a tugboat engine. In trying to adjust the brasses, I drive the key hard in, then mark it, and draw it back about an inch. The idea of leaving the brasses apart is that, in case of heating and wearing, the lost motion may be taken up. I have asked many engineers as to the advisability of keeping the brasses butted and the key driven tight, but I receive no answer."

This is one of those minor details of mechanical construction in which there is much difference in practice, and which is of considerable importance. The cause of the trouble in our correspondent's case is easily perceived on referring to his drawing; for the key has a taper of only $\frac{5}{16}$ inch to the



foot, and therefore would of its own weight alone place sufficient pressure upon the brasses to cause them to heat and abrade. In many cases, however, it is a difficult matter to adjust brasses that have the joints left open, for the following reasons: If the flanges of the brasses do not quite fit the length of the journal, as is very commonly the case, it is customary to tighten the key until the rod end can just be moved by hand so as to force the brass flanges against, first one, and then the other, end of the journal. This is an approximate adjustment; and if the journal heats at all, the key is slacked back a trifle: whereas if it pounds, the key is set up a little. As a matter of fact, then, nothing is actually known of the precise fit of the brass to the journal; and while looseness may be detected by the pounding, the brass may be tight enough to cause undue wear without very sensibly heating the journal, especially if the latter is freely lubricated. If, however, the brasses fit the length of the journal, and do not butt, as it is called, when the joint faces of the brasses meet it is usual to drive the key in till the brasses bind the journal, and to then slack the key back to the necessary amount. What that amount should be cannot be stated, because it varies with the taper of the key and the force with which it is driven home. As a result, then, the operation is left to the judgment, or, in other words, to guesswork, of men, many of whom are not well experienced in the operation; while under any circumstances the actual fit is not positively known. A plan not infrequently adopted is to insert a piece of lead wire of small diameter. After inserting it between the brasses, the key is driven tightly home; then the key is slacked back until the lead wire is just freed. It is estimated that the adjustment will then be correct; there is no actual certainty of the fit, however, even in this case.

If it be desired to insure a perfect fit, the brasses must be made to butt or meet together when the key is driven home; and in this case the brasses may be adjusted in position in the rod and upon the journal, with the other end of the rod free, so that it can be moved; and the fit can then be felt by moving the rod. If the rod is a heavy one, the brasses may be placed in the strap and tried in connection with the rod, as explained, so as to ascertain if the rod leads true to the other journal; then the fitting may be done with a half round file and scraper, and the brasses tried in the strap independently of the rod. The adjustment being nearly completed, the rod should again be applied to assure that it leads true to make any necessary alteration during the finishing of the adjustment. The journal having a faint coat of red marking, the brasses must be fitted until the fit can scarcely, if at all, be felt when the key is driven lightly home. The key should be marked with a line to show how far it was driven in during the adjustment; so that, in putting the work together, it may be driven in to the same distance. By this method, any number of bearings may be fitted, with the certainty that neither heating nor undue wear will take place; and if the bearings are properly proportioned to the duty, and if the metal of which they are composed is of suitable quality, the bearings may, if kept properly lubricated, be left to take care of themselves, even when quite new.

A compromise between these two methods is to put a strip of sheet brass between the brasses, and to file it down as the brasses wear; and this is most desirable for brasses the position of which is such that it entails much labor to take them out to let them come together. The wear on brasses butted together is not, as a rule, more than one half as great as upon those left open. In English and in a majority of American locomotives, and in small stationary engines, the brasses are made a butt joint; and in English shops, in all engines and machines, open brass joints are interdicted unless the position renders it difficult to take them out for adjustment.

THE ENGINEERS' EXAMINATION OF THE NIAGARA SUSPENSION BRIDGE.

The suspension bridge over the Niagara river was constructed by John A. Roebling in 1855. It has a span of 821 feet, and a deflection of 59 feet; 14,560 wires are employed in the cables, the ultimate strength of which is 12,000 tons. Since its completion, in the year above mentioned, the bridge has been subjected to the almost constant strain of heavy railroad trains; and thus for a period of 22 years it has undergone a trial of the greatest severity. Quite recently, it was deemed advisable to overhaul the structure thoroughly in order to determine whether any repairs were required, or whether the jarring or straining to which the wires had been submitted had—as some theorists believed possible—impaired the quality or tenacity of the iron. Accordingly the bridge was closed to travel; and to Colonel William H. Paine, Assistant Engineer of the East River bridge, was assigned the duty of critically inspecting the structure. We are indebted to Colonel Paine for an account of his investigations, which have resulted in his conclusion that the safety of the bridge is in nowise lessened. The detailed report of the engineer will be looked for with great interest, as it will undoubtedly add much to our knowledge relative to the durability and strength of the suspension system of bridge building.

The anchorage cables were imbedded in masonry and cement, which it was necessary to remove in order to admit of their examination: a task of no small difficulty, as the masonry was like solid rock. It was found that out of the 14,560 wires less than a dozen were seriously corroded, and these were in the first anchorage. The metal on the other wires showed the original grain with distinctness. Not content, however, with this highly favorable appearance, Colonel Paine proceeded to experiment upon the wire, in order to discover whether the means provided to allow of its expansion and contraction—namely, the placing of the bed plates which receive the cables on top of the towers, on rollers—had been sufficient to prevent the longitudinal stress upon the filaments destroying their elastic quality. An apparatus was used capable of marking a stretch to $\frac{1}{10000}$ of an inch; and this being adjusted, a heavy freight train was moved upon the bridge. The elongation of the wire was found to be very nearly equal to that which the formula, used by engineers for ascertaining such results, showed the stretch of a perfect cable, similarly made, should be under like strain: so that not only had twenty-two years' service not resulted in any corrosion of the wire, but the elasticity of the same under the enormous strains had not been impaired.

In the second experiment, a single wire from one of the main cables was tested. A strand of 520 wires was selected, and the binding removed, so that every wire was perfectly free. Three wires were then chosen, and across them a knife mark was made. The middle wire of the three was cut at the mark; and on testing it by the delicate instrument above noted, it was found to have contracted to within a small fraction of what it should have reached when relieved from its portion of the weight of the bridge. In experiment No. 3, a single wire was detached and weighted until it broke. The object here was to see whether the nature of the metal had been altered; for if the iron had become granular and had lost its cohesiveness, the fracture would be a straight one, similar to that of cast iron. On the contrary, the wire, when subjected to the stress, extended until its diameter was reduced fifty per cent before it broke.

A cable guy was next selected and made to sustain a dead weight. The construction estimate places the maximum burden which that guy would ever be required to bear at 15 tons. The guy parted at 53 tons. To show how perfectly the wire had retained its original characteristics, Colonel Paine, having observed that the wire, on being removed from the cable, tended to coil in a circle of about 5 feet in diameter, sent to the person who had originally prepared the wire for its place for information as to the size of its former coil. He learned that it had been wound on a drum 2 feet in diameter, and that it had been subjected to a straightening process which took about half the curve out of it. Certainly no more remarkable proof could be adduced to show that the spring of the wire had in no respect been overcome.

Although the bridge has thus been shown to be thoroughly safe, and to have wonderfully withstood wear, still more elaborate examinations are to be made, and the structure will not be open to traffic until these are completed. We shall publish further extracts from the complete reports of the engineers either in these columns or in those of the SUPPLEMENT at as early a date as possible.

SINGULAR EXPLOSION OF AN ELECTRICAL MACHINE.

Professor A. E. Haynes, of Hillsdale College, Mich., sends us the following account of the explosion, 20th ult., of an electrical machine:

"While our Holtz electric machine was being used it suddenly exploded, blowing the fixed and revolving plates into thousands of pieces. It was in fine order, was working nicely at the time, with a student on the insulating stool, while the revolving plate was being turned quite slowly. Did you ever hear of a similar occurrence?

"During the evening of the same day, we had very much thunder and lightning, quite a rare occurrence when the snow is so deep, some 18 inches. The machine seemed to gather itself for an instant before the explosion, as does the battery of jars, sometimes charged by it. The report was as loud as several rifles. Please give your opinion of the explosion."

REMARKS: The cause of this explosion was, probably, the imperfect annealing of the glass, producing unequal strains, the stronger of these strains, assisted by vibratory impulse, at last overcame the cohesion of the plate, and it burst into fragments. Such examples are not infrequent. Last year we gave an account of the sudden shivering at Troy, N. Y., of a sheet of plate glass, eight feet square, from this cause. The glass was leaning against the side of a building at the time, when it suddenly exploded with a loud noise, breaking into a thousand pieces. One of the fragments struck a workman in the leg, and inflicted a serious wound.

Professor Hagenback has suggested that when plates and other glass objects are examined by polarized light, they will exhibit the prismatic colors if under the influence of unequal strains; and in this way defective glasses may be readily detected.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

The work of arranging, testing, and preparing for the laying the wires of the main cables is steadily progressing, and is watched with much attention by engineers and others interested in this remarkable work. As a matter for convenient reference, we subjoin the following epitome of principal facts and dimensions:

Construction commenced January 2, 1870.
Length of river span, 1,595 feet 6 inches.
Length of each land span, 930 feet (1,860 feet).
Length of Brooklyn approach, 971 feet.
Length of New York approach, 1,562 feet 6 inches.
Total length of bridge, 5,989 feet.
Width of bridge, 85 feet.
Number of cables, 4.
Diameter of each cable, 15¼ inches.
Each cable consists of 6,300 parallel (not twisted) steel wires, No. 7 gauge, closely wrapped to a solid cylinder.
Ultimate strength of each cable, 11,200 tons.
Depth of tower foundation below high water, Brooklyn, 45 feet.
Depth of tower foundation below high water, New York, 78 feet.
Size of towers at high water line, 140 x 59 feet.
Size of towers at roof course, 136 x 53 feet.
Total height of towers above high water, 277 feet.
Clear height of bridge in center of river span above high water, at 50° Fah., 135 feet.
Height of floor at towers above high water, 119 feet 3 inches.
Grade of roadway, 3¼ feet in 100 feet.
Size of anchorages at base, 129 x 119 feet.
Size of anchorages at top, 117 x 104 feet.
Weight of each anchor-plate, 23 tons.
Estimated total cost of bridge, exclusive of land acquisition, $9,000,000.
Estimated cost of land, say, $3,500,000.
Total estimated cost, $12,500,000.

Mortification and Water.

Professor J. M. Merrick, writing to the *American Chemist*, says: "In *Hoffman's Manual*, and doubtless in many other chemistries, directions are given for exhibiting the decomposition of water by sodium, the hydrogen gas being collected in a tall, narrow jar by pushing pellets of sodium under its mouth with a wire gauze spoon, etc. In both cases I used very small bits of sodium. Having blown an expensive glass tube to fragments in my own laboratory by this process, and having, in the presence of a large class, blown into minute atoms, with a noise like thunder, a large tube and porcelain cistern, covering myself with mortification and water, and cutting gashes in my hand, I venture to suggest that possibly there is a risk in this experiment, as laid down in the books."

You are right, Professor. There is certainly a "possibility of risk;" indeed, we are willing to go further, and say that there is absolute danger. Lucky that your eyes escaped injury. Such experiments should be banished from the lecture room.

School Life and its Influence on Light.

Under this title, Professor George Reuling, M.D., surgeon in charge of the Maryland Eye and Ear Institute, Baltimore, contributes to the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT a large amount of valuable practical information concerning the human eye. He explains its general construction, the operation of controlling its muscles; points out how school children become near-sighted; shows the proper remedies; and gives many particulars concerning the uses and care of the eyes that ought to be read and remembered by everybody.

Bursting of a Reservoir Dam.

Recent heavy rains in New England resulted in the breaking down of the dam of a reservoir at Staffordville, Conn. A body of water covering over 400 acres was freed, and rushed through the valley, overthrowing smaller dams in its path and devastating a portion of the valley of Stafford Springs. The flood moved slowly, so that time was afforded to people to get out of the way, but the loss of property was great, amounting, it is estimated, to over $350,000.

BELGIAN anti-friction metal is composed of copper 20, tin 4, antimony ½, lead ¼ parts. Mix all the other ingredients before adding the copper.

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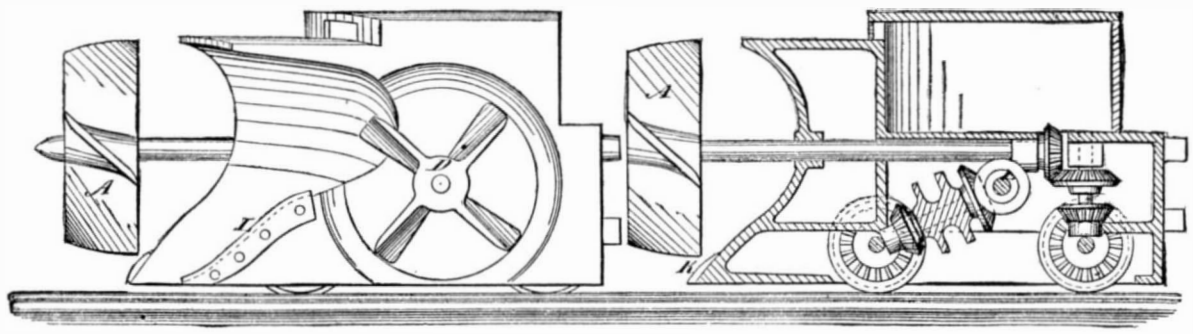
A SCREW SNOW PLOW.

Mr. Robert G. Little, of Halifax, Nova Scotia, is the inventor of the novel snow plow herewith illustrated, which was patented through the Scientific American Patent Agency, January 30, 1877. The new feature is the screw fan, A, projecting in advance of the plow on a horizontal shaft, which assists in throwing the snow off at and back along the sides of the plow. On each side of the plow there are fans, D, to receive the snow from the front and project it off at the sides, said fans being turned by a shaft arranged transversely of the machine. The side fan shaft is geared by countershafts with the front axle of the plow. If preferred, an engine may be mounted in the cabin of the plow specially for driving the fans, steam being furnished to it from the boiler. K and L are cutters attached to the plow for cutting the snow when packed hard.



LITTLE'S SNOW PLOW.

PHOTOGRAPHER'S RETOUCHING DESK.

This is a desk for artists' use, which enables the retoucher to see perfectly his work, get at it with ease and facility, and continue working with precision and comfort, and it must materially tend to excellence in result. It is the invention of Messrs. Burrows & Colton, and is manifestly the outcome of experience, the invention of one who has felt what was wanted. The engraving will give an idea of the general arrangement.

The retoucher may as easily sit upright to the work as in a leaning, round-shoulder-inducing position. The base contains a drawer for holding loose portions of the desk, pencils, etc., and is provided with a pencil sharpener in a handy position. The desk proper can be placed at any suitable angle. It is provided with a circular revolving inner frame, with clamping screws, sliding in a groove to permit them to hold firmly negatives of various sizes. Behind a central aperture in this revolving table or stage is an attachment on the principle of a series of revolving diaphragms, containing three apertures, any one of which can, on revolving the disk in which they are contained, be brought immediately behind the aperture in the desk, over which the negative rests during retouching. This affords facility for modifying the lighting through the negative. In this revolving disk, in each of the three apertures, is a different kind of glass—one plain, clear glass, one fine ground glass, and one opal glass. This arrangement enables the manipulator to judge with accuracy as to the effect of his work on the negative, and guides him in modifying the amount or style of the work he is applying. Placed underneath the desk is a concave silvered reflector, for throwing up a satisfactory light on the negative; this is of great value, either for daylight or artificial light. As the circular table or stage in the desk readily revolves, the artist is enabled to bring the negative in a moment into a satisfactory position for working on. By no means the least important adjunct to this desk, says the *British Journal of Photography*, is the magnifying glass, attached to a steady, movable arm of brass, with adjustment to place it in any position and at any focus to suit the artist. The importance of steadiness in the position of the magnifier cannot be over-estimated in saving the eyes of the workman.

A Large Snake at the Zoo.

That enthusiastic naturalist and writer, Frank Buckland, describes (in *Land and Water*) the recent arrival in London of an anaconda from South America. He says:

"This immense snake is now safely housed in the snake house in the Zoological Gardens, under the parental care of Holland, who has for many years so ably managed the snakes, poisonous and non-poisonous. Our visitor arrived at Liverpool in a large box. Intelligence was given to Mr. Bartlett, who proceeded to Liverpool to inspect him, a matter of considerable difficulty. It will not do to buy an expensive snake of this kind without a warranty. Snakes are very liable to canker in the mouth. The gums get swollen and flabby, and completely conceal the teeth, so that the beast cannot feed. Again, if snakes are injured in the capture, they frequently die in consequence. It was necessary to examine the snake as to these two points. Having been shut up for several months without food, and in the dark, the anaconda was not in a good temper. When the lid was opened Mr. Bartlett caught him tight round the neck with both hands; it was not necessary to open the mouth, as the savage snake did that soon enough of himself, in true anger. A moment's inspection showed he had no disease of the gums. It was with some difficulty that Mr. Bartlett got his head back into the box, without letting out more than a foot or two of his body. The anaconda has not poisonous teeth, but has great and dangerous powers of crushing. The box with the snake weighed over 2 cwt. It was with much dodging that Anaconda was conducted by two keepers to his new quarters, where he at once retreated into a bath of warm water, from which as yet he has only emerged once or twice. It is difficult to give the exact length of the snake, as he is not to be measured with as much facility as a fathom of rope. He is now lying in three parallel folds in his bath; we know the length of the bath, and we calculate his length to be between eighteen and twenty feet—a tremendous fellow! It was impossible to get a tape measure round him; but having measured his diameter in his thickest part, we conclude that he is over two feet round the body. At present he is thin, and his skin fits him very loosely. It is hoped that he will soon begin to feed. Mr. Bartlett, with his usual ingenuity, has found out how to make Mr. Anaconda feed. He covers his bath over at night, and puts therein with the snake a duck. The duck is always gone in the morning, and the snake appears fatter. Anaconda is decidedly nocturnal and aquatic in his habits. Like our own British snake, it is found in marshy, damp places, and he feeds upon animals which come down to drink at night. Mr. Bartlett has ascertained that the last meal of this snake had consisted of a young peccary, the horny part of the hoofs having been discovered in the stones at the bottom of the cage; there are also the hairs of another animal, which has to be diagnosed by microscopists. This tropical American snake is also called the *aboma*. The provincial name is *el traga venado*, or the deer swallower. He never interferes with men, although of course he will take his own part if attacked. It is greatly to be hoped that this magnificent snake will in time get an appetite and recover from his travel-worn appearance. His color may be described as buff, with very dark markings on the upper parts. His companion in the cage is a magnificent reticulated python (*ular sawa*), caught at Penang. He has been at the gardens since August, 1876, and has not eaten anything since he arrived. He shed his skin recently, and is now most lovely to behold. It would be impossible to describe the tints of the new skin (a splendid lacing of bronze, blue, gold, and black), except by saying that they are quite as gorgeous as a peacock's plumage.

"I have had some snake skins tanned, a lady having promised to wear a dress ornamented with them. Eve dressed in snake skins is too good a point to be overlooked."

A Fountain on a Spire.

The Virginia (Nev.) *Enterprise* of March 6 says: "Last evening, about 4 o'clock, the eyes of hundreds of persons on the streets were directed towards the top of the spire of the new Catholic church, where was seen a fountain spouting numerous jets high in the air. A large iron pipe is carried up through the steeple and up the large cross surmounting the same. The pipe then takes the form of the cross, behind which it is hidden, and from holes perforated at proper intervals the jets are sent up. From the top of the cross and from the end of each arm large streams ascend to the height of about 25 feet, and between these are thrown up a great number of smaller jets. The height of the top of the cross from the ground is 170 feet, and last evening, the air being calm, the numerous jets spread out in the shape of a fan. The rays of the declining sun fell upon the jets and spray at just the proper angle to light up and bring out the whole in a beautiful roseate glow which surrounded the top of the cross like a glory. This novel fountain was not constructed for mere ornament. It is intended for use, in case of the breaking out of a large fire, as a protection to the spire and roof of the church. It is but the work of a moment to turn on the water and drench the spire. The height to which the water is thrown above the cross shows the great force of the water works of the city."

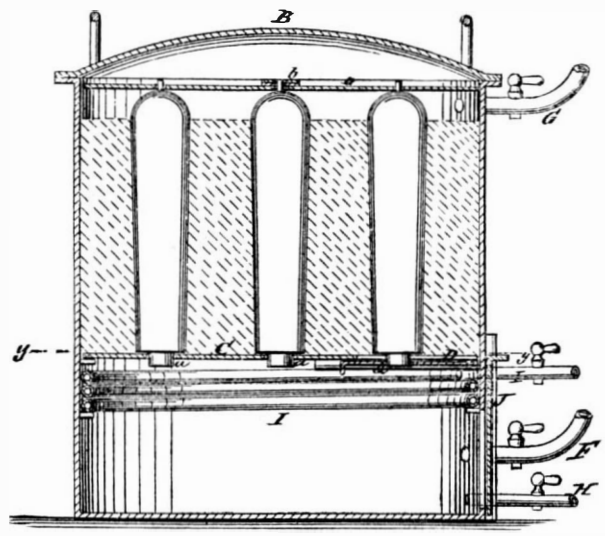
Now is the time to purify your chicken houses to prevent disease. Burning sulphur in the houses; sprinkling with carbolic acid; whitewashing with hot lime; cleaning out frequently; providing new nests; providing liberally, ashes, charcoal, burnt oyster shells, lime, gravel, pure water, will all aid in stopping or warding off disease.

How to Photograph Microscopic Objects.

Dr. Fayel lately presented to the Academy of Sciences, Paris, the details of a new method of micro-photography. He placed upon a window sill the microscope he employs for the purpose, which had over the top a small wooden box supported on a tripod. This wooden box is the camera, which can be fitted and removed at pleasure, and has a plano-convex lens inside the camera, moved by a screw. By calculation the author had determined, first of all, and noted upon the exterior, the different heights that the camera, should occupy, in order to secure enlargements with the various powers employed, the image refracted by the lens being projected upon the focussing screen of the camera of the same size exactly as it is seen with the eye. Matters thus regulated, M. Fayel takes the microscopical preparation it is desired to enlarge, and reproduces and examines it under the microscope; and when the latter has been properly focussed, the camera is put in its place, without touching either the microscope or the preparation, the eyepiece remaining in its place. He brings the lens down to the point corresponding to the scale referred to above, and, without even taking the trouble to look at the image upon the ground glass, he forthwith proceeds to put a sensitive plate into the apparatus. When the exposure is at an end, the *cliché* is developed in the ordinary way. The advantages claimed by Dr. Fayel for this mode of operating are the following: 1. It furnishes to the physiologist the possibility of taking a photographic image of any object visible under the microscope, no matter to what scale it is enlarged. 2. It permits the production of an image without touching the microscope or the object or preparation under it—there is no need even to focus after the camera has been adjusted, because this is done automatically, and always remains the same. 3. It yields an image of the dimensions precisely of that seen through the eyepiece; and, finally, it allows one to transfer to a competent operator all the photographic labors connected with the affair. The micro-photographs presented to the Academy of Sciences as the fruits of this apparatus were of a most interesting and remarkable character.

A NEW SODA-CARBONATING APPARATUS.

James McCloskey, of East Cambridge, Mass., has patented through the Scientific American Patent Agency, January 30, 1877, a new apparatus for carbonating soda, which we illustrate herewith. It consists of a chamber, A, having a horizontal perforated partition, C, near its base, and a number of removable shouldered pins, E, that rest in the perforations of the partition, and are removed when the chamber is filled with soda ash, leaving corresponding openings in the contents of the chamber. F and G are gas pipes, and H is a steampipe, for introducing steam into the chamber for facilitating the process of carbonizing. I is a coil of steam pipe for heating and drying the soda, should it become too moist to grind.



The manner of using the apparatus is as follows: The cover being removed, and the pins, E, being in their places, chamber A is filled up to the rounded portion of the pins, E, with soda ash. The pins are then removed, leaving openings through the soda ash above the perforations in the partition. The cover, B, is placed and sealed, and carbonic acid is introduced through either or both of the pipes, F G, and more or less steam is also admitted through the pipe, H. The openings left by removing the pins, E, expose a great amount of surface to the action of the gas; hence the process is facilitated.

The advantages claimed for the apparatus are that, with it the process is completed in much less time than by the ordinary method, and the discoloration commonly produced by the wooden trays is entirely obviated.

BODY COPAL VARNISH FOR COACHMAKERS' USE.—Fuse 8 lbs. fine African gum copal, add 2 gallons clarified oil, boil slowly until quite stringy, mix with 3½ gallons turpentine, and strain. The boiling will take 4 or 5 hours.

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THE PROPAGATION OF NERVE EXCITEMENTS.

Physiologists differ widely on the question as to whether moter and sensory nerves are identical or different in their formation and capabilities: in other words, whether a sensory nerve may conduct excitations having for their result a bodily movement, or *vice versa.* It is not even definitely known whether an excitation of a nerve near the middle of the latter propagates itself simultaneously in both directions, centripetal and centrifugal. In order to obtain some *data* on this interesting subject, M. Paul Bert has recently made some curious experiments, an account of which, with the accompanying illustrations, we find in *La Nature.*

If at any point of its length, says M. Bert, a sensory nerve be pricked, the pain experienced indicates quite clearly that the excitation is propagated in centripetal direction. We have no similar certain knowledge that centrifugal propagation occurs, for the simple reason that at the terminal extremity of the nerve there is no perceptive nervous apparatus. Now if we can succeed in placing that extremity in connection with a perceptive center—that is to say, with the brain—then, if we find sensation, it must follow that centrifugal propagation takes place.

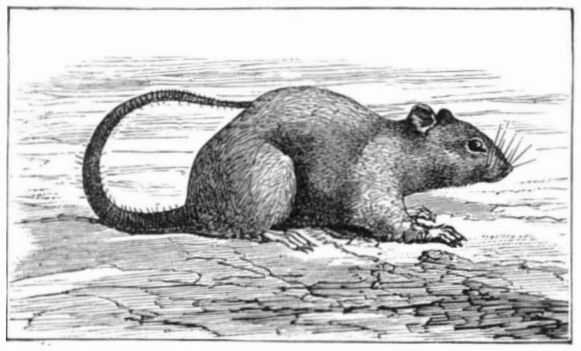


FIG. 1.—M. BERT'S EXPERIMENTS ON THE NERVES.

A rat was the subject of the experiment thus indicated. The skin was removed from the end of the tail of the animal for a distance of nearly an inch; and an orifice being made above the spine, the exposed end of the tail was inserted in the cellular subcutaneous tissue. A few sutures sufficed to keep the parts in place, and eventually complete adherence was obtained.

At the end of eight months the tail was cut at about the middle; so that the animal had two tails apparently—one growing out of the back, the other in natural position. Immediately after the section, the dorsal portion was manifestly sensitive; as, when it was pinched, the rat squealed, and attempted to escape. It was therefore evident that, in this fragment of the tail, excitation of the sensory nerves was propagated from the large to the smaller end—that is to say, in inverse direction to the supposed normal course. What had occurred?

The sensitive nerves, says M. Bert, which extended to the end of the tail, wounded by the removal of the skin, united with the nerves of the dorsal region, which had likewise been cut in making the necessary orifice. After a sufficient period, the nervous cicatrix became capable of passing vibrations. Then, when the end of the dorsal tail was pinched, the vibration traveled in the excited caudal nerve, traversed the cicatrix, and followed the dorso-cutaneous nerve to the spinal marrow, which conducted it to the brain, which organ translated the vibration into a sensation of pain. This will be clearly understood from Fig. 2, in which M E is the spinal marrow, and N C one of the nerve filaments passing to the end of the tail, the extremity of which was exposed. G is its ganglion, N one of the nervous filaments in the back exposed when the orifice was made, C the nervous cicatrix formed when the nerves united, S the point of section of the tail, and *a b* arrows indicating the two directions in which the excitations which determine sensibility are propagated.

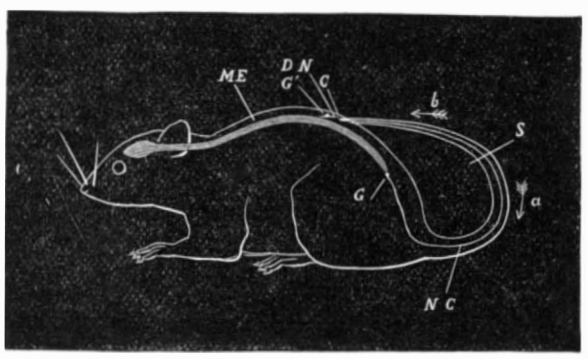


FIG. 2.—M. BERT'S EXPERIMENTS ON THE NERVES.

On the second day after the section was effected, the sensibility of the dorsal tail diminished and finally disappeared altogether. Examination with the microscope showed that the nerves of this portion had undergone the usual alterations of nerves separated from their trophic centers, and that this had taken place in part under the skin as well as that outside, although the appendage had grown to the animal and seemed healthy and vigorous. The nerves in the true tail were, on the contrary, perfectly free from degeneration.

M. Bert's conclusions are that an excitation in a sensory is propagated simultaneously both centripetally and centrifugally; and he thinks the same holds true for motor nerves. It is also very probable that, as Vulpian has shown, nerves are simple conductors, which are differentiated only by their mode of working, which depends upon the apparatus existing at their air extremities: namely, nervous motor cellule and muscular fiber for motor nerves, receptive nervous cellule and impressionable termination for sensory nerves.

Clothes Pins.

The Newark *Advertiser* says: Insignificant as the common wooden clothes pin is itself, its manufacture forms no mean part in American industries, and the numerous factories in New England and other States furnish employment to thousands of people. There are several large clothes pin manufactories in Pennsylvania and Ohio, and one in the vicinity of Saratoga, N. Y., each of which is capable of turning out a thousand boxes, or 72,000 pins, per week. There are several small factories scattered throughout Massachusetts, New Hampshire and Vermont, and all are run by water power. As a rule, those engaged in the manufacture of clothes pins are Quakers. Beech, white birch, and poplar are the woods used in making the article, the birch and poplar being considered the best. The machinery employed is very simple. The wood is first sawed into logs four feet in length, and then cut into small square sticks by means of a cutting machine. Each stick, after being rounded in a lathe, is passed into another machine which throws out a number of perfectly formed pins at one cut and with great rapidity. The pins are then thrown into a large revolving cylinder and smoothed by friction with each other. New York and Boston are the principal markets for this ware, and hence they are shipped in large quantities to the West, and to England and Australia. Over 100,000 boxes of pins are annually sent to England, and a corresponding number to Melbourne, Sydney, New Zealand, and the Sandwich Islands. Owing to the depression in business, during the past two years prices have fallen off 25 per cent, and some of the manufacturers in New England have ceased operations because they could buy cheaper from the West than they could manufacture themselves, besides saving the expense of packing and transportation. The price depends entirely upon the finish and number in a box.

An Observatory on Etna.

Professor Tacchini sends us a note read before the Genoese Academy on September 22, 1876, entitled, "On the Convenience and Utility of Erecting an Astronomico-Meteorological Station on Mount Etna," in which, after describing his experiences during a brief ascent on September 15 and 16, he expresses his views with regard to the establishment and most desirable fitting of an observatory on the mountain, to be mainly devoted to spectroscopic and meteorological observations.

Professor Tacchini ascended on the morning of September 15 from Catania to the station occupied by a party of the English and American expeditions on the occasion of the total solar eclipse of December, 1870, and found there a diminution of temperature of 73·8° Fah. He had taken with him a Dollond telescope of 3¾ inches aperture, a spectroscope of strong dispersion by Tauber, a small spectroscope of Janssen, an aneroid barometer, thermometers, and a polariscope. At 10h. 30m. A.M., on the 16th, a few detached clouds only being present, he remarked that the blue of the sky was much deeper than at Palermo or Catania. The solar light had a special character, it seemed whiter and more tranquil, as though due to artificial illumination by magnetism. Viewing the sun rapidly with the naked eye, it was seen as a black disk surrounded by an aureola of limited extent, projected on the blue ground of the sky. On interposing an opaque body before the disk the aureola was seen better, but always limited, and the pure blue sky terminated the same, which extended to rather more than half the solar radius; with the naked eye it was difficult to judge if the aureola was of equal breadth all round the disk, and the only thing well marked was the difference from the view obtained at the level of the sea; while the sky is ordinarily whitish about the sun, on Etna it remained blue, and the aureola acquired a better defined contour. With a helioscope the aureola was much better seen, and its border appeared irregular, and as though it were rather more extended at four points, which, at noon, corresponded to the extremities of the vertical and horizontal diameters of the disk. At 3 P.M., after interruptions from clouds (which in passing rapidly at short intervals produced a striking effect by the formation of a stupendous series of colored rings round the sun, containing all the gradations of color in the spectrum, a phenomenon new to Professor Tacchini), the Tauber spectroscope was applied to the telescope for examination of the solar spectrum, and the observer expresses his surprise at the fine definition of the lines and the extraordinary distinctness of the whole; the chromosphere was bright.

In the evening, at 10h., the spectacle of the starlit sky was novel and enchanting. Sirius appeared to rival Venus, the finer constellations acquired an altogether special aspect, and the appearance of the *Via Lactea* was astounding. The image of the planet Saturn was admirable, and the peculiarities of the ring and belt were seen to much greater advantage than at Palermo, shortly before leaving. Venus afforded remarkable proof of the rare quality of the sky of Etna. The planet shown with a powerful light, which cast shadows during the ascent of the mountain; it scintillated frequently like a star. The telescope showed, on the northern part of the phase, an oblong space, less illuminated than the rest of the disk, which Professor Tacchini says was "sicuramente una macchia del pianeta."

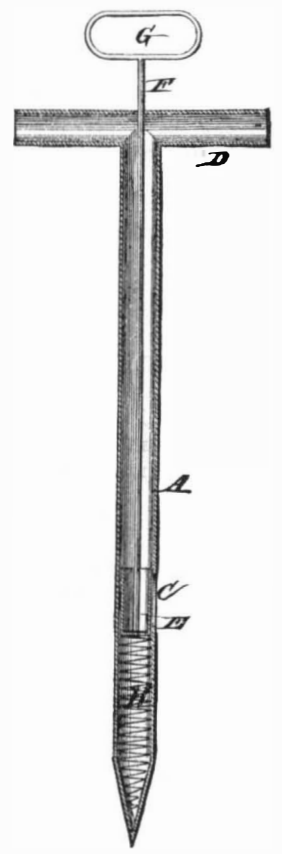
Spectroscopic observations were renewed on the following morning, when the sun had attained an altitude of 10°. The chromosphere was magnificent; the inversion of the magnesium and of 1,474 was immediately evident, which was not seen at Palermo with the same telescope.

With regard to the proposed observatory, which Professor Tacchini is desirous should be an accomplished fact before the meeting of the scientific bodies at Rome in September next, he proposes that it should be erected at the *Casina degl' Inglesi*, and should be named after Bellini, and that it should belong to the University of Catania. He suggests that it ought to be provided with a refractor of first-rate quality and of at least about 6·3 inches aperture; and he advises that, while the meteorological instruments, which should be adapted to the requirements of the day, as indicated by the London Congress, would remain constantly at the Bellini Observatory, a duplicate mounting might be provided for the refractor at some spot within the University of Catania, with its proper dome, the other being fixed on Etna: so that, while from June to the end of September astronomical observations could be carried on upon the mountain, during the winter they might be made at Catania, where the sky is a very good one; the astronomer would thus have only the object glass with its tube to transport to and fro. Professor Tacchini further suggests that accommodation for visitors should be provided, with the view to increasing their numbers, and that a certain payment should be made by them, to go towards the maintenance of the Observatory and its custodian.

We wish every success to the scheme thus energetically brought before the Italian authorities by Professor Tacchini, and have no hesitation in predicting important gains to Science from its adoption.—*Nature.*

IMPROVED GRAIN SAMPLER.

We illustrate herewith a simple device for sampling grain in bags or in bulk. A is a pointed tube, which is provided with an aperture, C, in one side. A tubular handle, D, is attached, and a valve, E, is provided for closing the aperture. A rod, F, is centrally attached to the valve, E, and runs through the handle, D, and is provided with a handle, G. A coil spring, H, is placed in the tube, A, between the coned end and the valve, E, for closing the said valve. When a sample from the interior of a body of grain is required, the tube, A, is forced into the grain as far as may be desired, when the valve, E, is pushed back, opening the aperture, C, allowing the grain to run into and partially fill the tube, A. The rod, F, being released, the spring, H, returns the valve to its normal position. The instrument is removed from the bulk of the grain, and the contained sample is poured through either arm of the tubular handle. The conical end permits the insertion of the tube in bags by displacing the meshes of the material of the bag as the tube is forced in.



Patented through the Scientific American Patent Agency December 5, 1876, by Mr. J. F. Gent, of Columbus, Ind.

A Salmon's Endurance.

Land and Water relates the following, concerning a remarkable battle lasting for sixteen hours, between a plucky sportsman and an obdurate salmon, before the latter was conquered: "On Friday, at four P. M., Mr. A. Crawshay hooked a fish below Haughton Castle, but did not land him till Saturday morning, the 24th inst., at eight A. M. Immediately after being hooked, the fish went down the river, taking out upwards of 100 yards of line. The water being strong and the fish determined, it was impossible to get him back. A wood by the water side made it equally impossible for Mr. Crawshay to follow his fish, and so things remained until a boat was brought at daylight next morning from some distance, by which means the wood was passed, and the fish at last landed on a gravel bed, in the presence of many spectators, some of whom had passed the night with the angler. The fish was a splendid male, forty inches long, and twenty-two inches girth; weight, 25½ lbs."

Portland Cement.

Mr. I. J. Mann, assistant engineer, Port and Docks Office, Dublin, has made experiments upon the qualities of Portland cement, which prove that coarsely ground cement when used neat (without sand) is stronger than finely ground cement; but when used with sand, as in concrete and mortar, it was found that cement containing only twenty-five per cent of coarse cement particles had but half the strength of mortar mixed with fine cement, the cement used being in each case four weeks old. On the other hand, extremely fine sand diminished the strength of the mortar to less than one half of that which was mixed with coarse sand.

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[*Continued from first page.*]

ing above mentioned. Its forward end is suitably connected to a second pivoted bar, G; so that, when the first bar has a lateral movement, that motion is, through the connection, transmitted to the second bar. To the rear extremity of the latter is attached a chain which passes around and is secured to the small cam, H, Fig. 1. I is a larger cam, rigidly attached to and hence working on the same pivot as cam, H. Around cam, I, and secured to it, is another chain, which passes over a guide pulley at the rear end of the platform and is fastened to the caboose car. The peripheries of each of these cams, or rather eccentrics, gradually increase from the point of connection of the cables, so that the caboose is thus made to serve as a counterweight to the resistance of the plows and drag, adapting itself readily to increased or decreased strain.

The present invention is one of a series designed for grading railroad beds in all situations, except through stone, and also to keep the same in repair. Two other machines have been devised, one to make a "cut" and a "fill," and the other for ditching purposes.

Parties who will interest themselves in the securing of contracts for use of the device above described are invited to address the inventor, Mr. J. J. Harden, 83 West Van Buren street, Chicago, Ill.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the general stagnation of business, the issue of patents still keeps on, the hard times appearing to have sharpened the wits of our inventors, thus proving, in more senses than one, that "necessity is the mother of invention," and causing the business of the Office to increase very much of late. The issue of March 6 was about four hundred, including patents, reissues, designs, trade marks, and labels.

An examination of the list of the acts of Congress of the last session that received the signature of the President shows but three relating to patents, namely, the acts for the relief of Henry Voelter, T. Bussell, and W. W. Hubbard. The first two of these is to authorize the Commissioner of Patents to extend the patents of the two gentlemen named, the first for a process for the manufacture of paper pulp from wood and the other for a car spring. The last act, according to the title, is "to make compensation for the past making, using, or vending of his patent explosive shell fuses and percussion exploders by the United States." There were other patent extension cases passed, but failed to meet the approval of the President, and hence have not become laws. No sewing machine patents have been extended, and it therefore appears that the monopoly of the sewing machine combination is about to end, and that about May next the prices of sewing machines will drop to a reasonable figure, or as soon thereafter as other manufacturers can supply the market.

Mr. Nathan Appleton has been in consultation with the late Centennial authorities at Philadelphia, and, as a result, has presented to Secretary Evarts a sketch of an organization for the proposed American exhibit at the next Paris Exposition, together with an estimate of the necessary expenses. He estimates that $300,000 is the least amount with which a proper exhibition can be made,and this on the supposition that the goods will be received at New York in government warehouses and shipped to Havre in United States Government vessels. He believes, however, that $500,000 should be appropriated to do the country credit at Paris. The gentlemen who are shaping the present movement entertain strong hopes that the President will be able in some way to accept the invitation of the French republic at an early date, as they find there is a general desire among Americans to take part in the Exposition.

I hear of no changes worth noting in the officials of the Patent Office, although rumors of the proposed removal of the Commissioner and his assistant have been flying around of late; but I have been unable to trace these rumors to any reliable source, and it is generally believed there is no foundation for them, as the new Secretary of the Interior is said to be a strong believer in civil service reform, and he would have to stultify his past record to make these removals. He is said to be now engaged in framing his views in relation to the civil service into the form of a code of rules to govern the department over which he presides, and which will, it is believed, form the basis of the government of the other departments in the matter of appointments, etc. It is reported that he has signified his intention of making no removals where the incumbent proves qualified, diligent, and efficient, and it is therefore hoped that all the trustworthy officials in the Patent Office will retain their positions.

The Post Office has invited tenders for the contract to manufacture postal cards for the next four years, from which it appears that, during the last fiscal year, 150,815,000 cards were issued; and it is expected that the issues for the current year will be about 180,000,000. It is thought that the number required during the next contract term will reach the enormous number of 1,000,000,000 at least.

Washington, D. C. OCCASIONAL.

Friction of Slide Valves.

To the Editor of the Scientific American:

In your SUPPLEMENT, No. 62, there is an article by Mr. Hill on the friction of slide valves, which, while it contains some truth, is yet enough in error to deserve notice. Allow me to say in the beginning that I am not one of those "semi-mechanics" who, to use Mr. Hill's expression, have been "peddling" balance slide valves. I am simply a mechanic who, in common with a great army of similarly situated men, contrive to gather up from year to year considerable information from the columns of the SCIENTIFIC AMERICAN, and it is because so many young mechanics make that paper their textbook that I venture to offer objections to Mr. Hill's conclusions. There are in the country mechanics who have invented, and no doubt to some extent "peddled," balance slide valves, and who, in point of ability, might not suffer in comparison even with Mr. Hill himself, and it certainly does not assist his argument to disparage these men at its commencement. Some of these inventors have, as is well known, supplemented fair scientific attainments by exhaustive practical experiments; and while they do not claim to save "25 to 50 per centum" they do claim to show a slight saving in fuel, a very material saving in eccentric and connection to valve, and undoubtedly considerably more than the highest figure named by Mr. Hill in the wear of valve and seat and consequent "blowing." Mr. Hill is certainly to be commiserated if, in all his varied experience, "there is not a single relieved valve in use" that does not leak to the extent he indicates; and he may be assured that he can find several of them in this section which have been running from two to five years without any repairs whatever. All the leak from the packing of these valves passes directly into the engine room without becoming a nuisance at that. So much for Mr. Hill's gratuitous attack upon the venders of balance valves.

In regard to that very useful and somewhat intelligent class, engine builders, whom he tells with so much modesty that they have always been in the wrong as to the pressure on a slide valve, it is to be presumed they will hold their "erroneous ideas" notwithstanding the demonstration which makes the case much clearer to Mr. Hill than to men who know better by experience. There need be no question in any one's mind, if he obtain his data for balancing slide valves from these conclusions, that it will not require even a "very short time" for them to become so leaky as to be voted a nuisance. In fact, were Mr. Hill to construct a valve of the dimensions indicated in his article, deducting as constant counterpressure his steam post and additional area, which at full steam chest pressure shall be the equivalent of the highest pressure reached by compression acting constantly upon the exhaust cavity of the valve, allowing besides a liberal margin for holding the weight of valve, there is no doubt any of the "half mechanics" would guarantee his valve to stay anywhere else in the chest rather than in its proper place against its seat.

Troy, N. Y. NOT A PEDDLER.

Facts in Nature.

To the Editor of the Scientific American:

I read in your journal for March 17 an article entitled "Do Snakes Catch Fish?" Perhaps it is not a generally known fact, but most of our water snakes are expert fishers. Especially so is our common species, *tropidonotus sipedon*, Linn. Last spring my brother witnessed the capture of a water snake in a small stream flowing into the Schuylkill. The stomach of the snake was observed to be greatly distended, and on being cut open, to ascertain the cause, a large catfish, apparently just swallowed, was extricated. The snake measured two and a half feet in length, and the catfish seven inches. The fish was fully armed with the long sharp spines common to the genus, and must have proved a reluctant dinner, dying "game to the last."

I once saw a water snake in full chase of an eel. I was sitting on a small rock, quite near the surface of the stream, and observed them well. As they passed me, the eel led by about two feet; and as far as they were visible, the snake seemed to be gaining ground. But although I dropped my rod, and soaked my lower extremities considerably in the attempt, I was unable to see the termination of the affair. The snake appeared to be three feet in length, and the eel about the same size, certainly not more than two inches less. Professor Allen once saw a water snake hauled from the water and killed, that had a live pickerel in its mouth a foot in length.

The common water snake does not always capture its prey by a fair chase. I have several times seen it lying in wait among rocks and stones, with its head and part of its neck only visible; and when a fish or tadpole swam by, it would instantaneously dart forward and seize the unknowing trespasser.

Philadelphia, Pa. C. F. SEISS.

Patterns for Fret Saw Work.

To the Editor of the Scientific American:

Those who wish to duplicate the above named patterns find the use of impression paper tedious and inaccurate. My method is as follows: Take two pieces of wood of proper size, cut any number of sheets of common writing paper to the same size as the wood, place the sheets on one piece and tack the other piece of wood to it with the paper between. Paste your design on one side and saw through paper and all. Saw the holes first and then the outlines accurately; and when done you will have as many beautiful designs as you wish with the least possible labor.

McLean, Ill. FRET SAW.

The Frost Plant of Russia.

To the Editor of the Scientific American:

In your issue of February 24, I see a picture of what is entitled "The Frost Plant of Russia." I have seen the identical phenomenon on a certain kind of weed stalks in Fayette county, Tenn. While teaching a country school in that county, in 1873–4. my school children and I gathered the "frost flowers" frequently. They were most beautiful in the morning, and usually melted away during the day when the sun shone. I do not think that snow had any influence over them, and am of Dr. Darlington's opinion as to their formation.

Fall River, Mass. T. R. VESTAL.

Beavers in California.

The Stockton (Cal.) *Independent* publishes the following: "As the tules of this vicinity abound in beaver, numbers of hunters and trappers have made an excellent living in capturing them for their pelts. The latter are worth $2.50 each, and an industrious trapper can catch from 30 to 50 a month. In the equable climate of California the time of year seems to have no especial effect on the excellence of the beaver fur, it being equally good in summer and winter. The trapper can, therefore, pursue his avocation uninterruptedly the year through. With the beaver he can catch and the other game he can send to market, an industrious man can make $100 a month and live as his own master. The trapper's outfit for the San Joaquin tules is a peculiar one. Two hunters usually join together in the outfit of an ark, or floating house, with which they paddle out through the innumerable sloughs that intersect the pathless jungle of tules. The ark affords one small room or cabin, provided with sleeping bunks, and furnished with a stove and complete culinary outfit. In this ark the hunter lives in comfort, always having a shelter, while its compact shape and size allows it to float in the smallest stream, thus bringing the hunter and his home in the very midst of his game."

A New Fire Extinguisher.

A new fire-extinguishing chemical compound has been lately devised, which, in its application for extinguishing fires, is quite different from the fire annihilators in general use. The new composition is a mixture of chemicals which, on being ignited, evolve sulphurous acid and carbonic acid gases, which fill the apartment or building, producing an atmosphere which smothers combustion. A successful trial of the invention was recently had in front of the City Hall in this city.

A board shanty, 13 feet square and 10 feet high, was erected to represent an apartment, and furnished with a door, window, and a stovepipe coming through the roof. The interior was coated with tar. On a bench were placed seven basins containing benzine, coal oil, and naphtha. In one corner was a 10 lbs. box of the extinguishing compound, with a fuse attached to it running round the walls, on the self-igniting plan. The combustibles were set on fire, and in an instant the interior was one sheet of flame, bursting out through the door, window, stovepipe, and every aperture. A few moments after the compound was ignited, the gases that were generated therefrom instantly subdued the flames; and in less than half a minute the fire was entirely extinguished.

The new substance is called "Reec's Compound Fire Extinguisher." G. J. Crikelair, of 263 Broadway, is the general agent for New York, New Jersey, and Connecticut.

Good Forgers.

The question has often been asked us, says the *Carriage Monthly*, "How is it that some smiths are able to make better forgings than others?" or "How is it that ——— is always so successful with his welds?" The secret of all this is in first knowing how, and after knowing how, in doing, or trying to perform, what we know. The knowing smith so lays out his work at the close of the day that his first work in the morning will be the heaviest, and such as requires but little welding. By doing this he not only leaves the lighter portion of his labors for the waning of the day and also the tiring of his arm, but he removes the chill from the anvil and other tools to such an extent as to prevent the iron from becoming chilled before the weld is properly made. His fire is always clean. His tool rack is always in order, thus enabling him to grasp the required tool at the proper time. He never places his iron in the fire a second time until, with a file, he has removed all the scales. The ice-cold anvil will chill the thin part of the "scaff," and prevent the welding of that portion. It is impossible to take a clean heat with a fire full of slag. If you have to hunt five minutes for a tool, your iron has become cold, and unless you remove the scales and other matter, your forgings will not be perfect.

Sawdust in Rough Casting.

Siehr recommends very highly the use of sawdust in mortar, as superior even to hair for the prevention of cracking, and subsequent peeling off, of rough casting under the action of storms and frost. His own house, exposed to prolonged storms on the seacoast, had patches of mortar to be renewed each spring; and, after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried, and sifted through an ordinary grain sieve, to remove the larger particles. The mortar was made by mixing one part of cement, two of lime, two of sawdust, and five of sharp sand, the sawdust being first well mixed dry with the cement and sand.

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Progress of Rinderpest.

In view of the renewed and alarming appearance of this fearful malady in Europe, the Treasury Department has lately issued the following instructions to collectors and other officers of the customs:

"The prevalence of the rinderpest in Germany, and of that malady and the foot and mouth disease in England, has led this Department to prohibit the importation of neat cattle and the hides of neat cattle from those countries into the United States. By reason of the proximity of Holland and Belgium to Germany, and of Ireland to England, the prohibition is hereby extended to embrace such importations from those countries.

"The Department is informed that the rinderpest is infectious as well as contagious, and that sheep, horses, and swine may be media for its communication. It is also understood that the litter upon which these animals sleep spreads the disease. While the Department has no authority under the law to prohibit the importation of horses, sheep, and swine, it desires that all measures practicable be taken on the arrival of such animals from the countries named to prevent the possibility of contagious diseases being communicated thereby to stock in the United States.

"It is suggested that horses, sheep, and swine, coming from any of the countries named, be examined by experts, and, if necessary, quarantined for a reasonable time; to which it is apprehended that importers, as a rule, will offer no special objection, as it is to the interest of all concerned to prevent the spread of this disease in the United States. Blooded stock coming from the countries named may be admitted when accompanied by a consular certificate of non-infection, as authorized by Department's letter of the 16th of March last, it being presumed that such stock is selected with care, and that it would not be taken from herds which are infected with the diseases mentioned."

Cotton Seed Oil—Its Manufacture and Uses.

Among the great number of special industries created by cotton is the manufacture of oil from the seed. And although this product does not compare in value with sheeting, shirting, yarn, thread, and the remarkable variety of other cotton goods, yet the oil has even a closer connection with our bodies than the shirts on our backs. But, not to begin with the end, it is better to describe its manufacture before stating its destination.

Probably there ought not to be a cotton seed oil mill in the country, for the seed is valuable as manure and as food. Its seed is a strong fertilizer when crushed and composted, or when rotted alone; or even when plowed under whole, it is a material return to the earth for its generosity. The dried plant itself has but little strength, but it helps to loosen stiff soils, and therefore is plowed under or allowed to rot on the surface when the field is prepared for a new planting. The seed, when prepared as a fertilizer by crushing, rotting, or by grinding the dried oil cakes, is used as guano, in hills of corn, in drills of other grain, or spread broadcast on meadows and gardens. Another profitable use of the seed on a farm is to boil it with corn or meal and give it to cattle. It is excellent feed for milch cows in this form, or as meal made from the pressed oil cake.

The farmers who will sell their cotton seed at $7 per ton, delivered at the railroad, are few in Alabama, happily for the improvement of the country. In Louisiana and Mississippi, where the soil is rich and stock is scarce, the mills get enough seed to be profitable factories. There are about 10 in those two States. Here there are but two, and they cannot get sufficient seed for continuous work. Georgia, which is said to use now more fertilizers than any other State in the Union, has no oil mill. This should be counted a great addition to her thrift, if the bull can be pardoned.

The cotton seed as it comes from the gin has still some cotton lint. It looks like a white cocoon, about one third of an inch long and half as thick. In a mass the seeds adhere slightly together and look like a lot of dingy cotton waste. From such a heap they are shoveled into a hopper, in which a screw, revolving in a trough, divides them into small bunches and empties them into elevating cups on a belt. This elevator empties them into a revolving screen with meshes smaller than the seeds. Here the sand, dust, and other small particles of extraneous matter are sifted out and the seed passed into another elevator that empties it into a second revolving screen. This has meshes large enough to pass the seeds, but too small to pass the cotton husks or bolls, sticks, stones, jack-knives, and horseshoes, that often come with the seed. From there the seed passes into a gin, made expressly for the purpose, to remove the short lint left on it by the first gin. An elevator takes it to a huller for removing, or rather breaking, the shell. The huller is a heavy cylinder, provided with knives, that pass between teeth so close together that the seeds are cut in two or three pieces. The cotton ginned from the seed passes to a carding machine, and is there carded for use. It is available for butts, and other materials not requiring long fiber. It is used with success in the manufacture of cotton blankets, which, it seems, are highly recommended in this country.

The cracked seeds pass from the huller to a revolving sieve, or separator, that allows the meats to fall into a trough, but retains the shells. These shells are passed by a chute to the engine room for fuel. The meats go from the separator to a reciprocating sieve, which passes the pure meats through it, but retains the few shells with meats that were not separated, and sends these back to the separator for a second sifting. The meats pass between two heavy iron rollers of great force, and are pressed into thin flakes, making a meal of yellowish-green color. This meal is placed in the heaters, which are iron tanks about 4 feet in diameter and 15 inches deep. These are double, the inner vessel being surrounded by steam at a pressure of 35 lbs. to the inch. The meal is stirred and heated, being dry, for five minutes. This dry heat frees the oil from its envelope. The meal is then scooped into strong sacks about 2 feet long and 10 inches wide, and placed between boards hinged together as the covers of a book are. Several of these sacks are then piled under a hydraulic press of great force, and squeezed for five minutes; they are then passed to a second and heavier press for the same length of time, and then to a third press. The oil runs from the presses to a tank and settles during 12 or 24 hours. It is then barreled for shipment. The cake of cotton seed meal is taken out of the sack and stood on its edge in a rack to dry during three or four days. The cakes are then packed in strong sacks or are broken up and ground into meal again to ship in bags. The most of it goes to England for cattle food and as a fertilizer. Some of it is sold in this country as a fertilizer at $20 to $22 per ton. A ton of seed produces about 20 gallons of oil, worth from 30 to 35 cents per gallon.

The crude oil thus made is sent to refiners in New Orleans, Cincinnati, and New York. It has a yellow color and a sweet taste of nuts. It is used, crude, for painting, and mixed with lard oil for lubricating. It is also mixed with some lighter oil or spirit for miners' lamps, for which its non-explosive quality makes it valuable. When refined it is difficult to tell all its uses. It is mixed with many other oils and passes for them. Here in the South it is much used for cooking in place of lard; and many a bottle bearing an assuring French or Italian label for olive oil is filled with this product of the cotton plant.—*Letter from Alabama in New York Times.*

Cheerless Workshops.

There are scores of workshops in this and other countries that are far from attractive in regard to their surroundings and interior arrangements. Many of them are dark, crowded, dreary places, where a stated stint of labor is performed according to a prearranged agreement, for which a stipulated price is paid; and were it not for the daily call of want, there would be no incentive to labor. We have seen workshops that were dark and damp, destroying the health and buoyancy of the spirits of the operatives, when a small sum perhaps would add not only warmth and light, but fill the place with pleasant surroundings. The surroundings of the place of labor have more influence upon the operative than many are aware of. Give a mechanic clumsy tools to work with, a rough, dirty bench to work upon, imperfect light, scarcely elbow room, and but little care exercised respecting proper ventilation and warmth, and he will become careless, his work partaking of the character of his surroundings; he will think more of getting his wages at a certain time than of the completion of his work. A few years of this experience will spoil almost any workman, no matter how good he may be.

But give him, on the contrary, good tools to work with, and a nice place in which to perform work, and he will insensibly take more pains with it than in a badly arranged apartment. In a pleasant room he will, of his own accord, keep his tools and work in good order, and more cheerfully perform the task assigned to him. A kind of magnetic influence of the surroundings will infuse itself into the operative, and his work will partake of that and go from him stamped with the impress of the influence thus created.

The above is from one of our exchanges, the name of which, we regret to state, has been mislaid. The article contains sensible advice, and we are sorry we cannot credit the source of it.

The Smithsonian Institution.

Professor Joseph Henry says that he has been trying for years, in regard to the Smithsonian Institution, to get the government to understand that the great testator never intended, by his magnificent gift, to accumulate a mere deposit of scientific works, but to collect all manner of new information for distribution among the nations of the earth. He has at last accomplished this. Chief-Justice Waite takes the same view, and the institution is now sending contributions of American discoveries, science, art, antiquities, history, and inventions generally, to more than 2,000 universities and colleges in every civilized portion of the globe, and these in exchange return to us the printed evidence of their own successful researches in all these various studies and inquiries. Both these contributions from us to distant nations and from the distant nations to us are delivered free of cost, by order of the respective governments. Owing to careful investments in United States securities, there remains to-day to the credit of the institute $714,000.

A Small Flower Garden.

A writer in the *Western Farm Journal* recommends for a small flower garden the following list, as they do not require treatment, are good sturdy varieties, will stand neglect, yet do well: Asters, balsams, dianthus, petunias, phlox, calliopsis, verbenas, sweet peas, mignonette, cinnias, marigolds, and portulacas. The same writer again says: "The plants I have named will afford a profusion of flowers from June to October. Phlox will be the first to blossom, and then petunias will come on, and both of these flowers continue to increase in beauty until hard frosts come. Asters will be in perfection in August and September. Calliopsis begins to blossom in July, and nearly all the others come on early in that month. If old flowers are removed and not allowed to go to seed, you will have a much greater profusion of bloom. If you do not remove faded flowers, but allow them to perfect seed, you will soon see that your plants are losing a large share of their former glory. You can't expect a plant to ripen seed and blossom profusely at the same time."

Photo Magic Lantern Slides.

At a recent meeting of the photo section of the American Institute in this city, during a discussion on the above subject, Mr. Roche said that, for lantern slides, emulsion plates gave the finest films, good bath plates next, and carbon last; that silver pictures for transparencies gave brilliancy and more contrast, and that many of the pictures exhibited were under-exposed and over-developed, thus giving too great a contrast and lacking in detail. Pictures for the lantern should be full of detail, soft and brilliant. Anything approaching a veil or fog over the picture is fatal. The high lights should be almost clear glass. The opinions of other members coincided with the remarks by Mr. Roche.

Mr. Newton, the President, remarked that he presumed it was not generally known, even by emulsion workers, what an increase of sensitiveness to the action of light was produced on an emulsion plate by the application of the alkaline development. In this respect it differed entirely from the action of an acid iron developer on an ordinary bath plate: whereas the iron developer on an ordinary bath plate nearly destroys its sensitiveness to the action of light, the effect of an alkaline developer on an emulsion plate increases its sensitiveness at least a hundredfold. He also stated that he had fogged an emulsion plate during development with the light of a kerosene lamp turned low and protected with manilla wrapping paper. This was occasioned by simply holding it a little too near the light to determine the stage of development. The fog commenced nearest the light, and diminished in the ratio of its distance from it. In the center of the plate, beneath the rubber of the pneumatic holder by which it was held, and where it was entirely protected from the action of light on the back, it was wholly free from fog and remained perfectly clear. By exercising more care, in removing the lamp to a greater distance and protecting it with more thicknesses of paper, he met with no further difficulty. He gave it as his opinion that much of the trouble experienced by those trying emulsions arose from developing in too strong a light.

Mr. Roche stated that, in working some good emulsion, the plate during development fogged. He therefore stopped out all light possible in the dark room, and then the plates developed clean and perfectly free from fog, confirming the remarks of the President on that subject.

Chemical Prizes.

Among the prizes offered by the German *Verein zur Beförderung des Gewerbfleisses*, the following may prove of interest to our readers:

A silver medal, or its value, and 900 marks (about $200) for an opaque red enamel for gold, silver, copper, and bronze.

A gold medal, or its value, and 3,000 marks, for a substitute for caoutchouc, the same for a suitable substitute for gutta percha.

A prize of 1,000 marks for a concise, critical, and practical treatise on cements; also 1,500 marks for the best investigation of the cause of a change in the zero point of thermometers, with a method of preventing or remedying it.

A prize of 2,000 marks for the best series of iron and manganese alloys, at least twenty samples to be prepared, containing from 0·5 to 5 per cent of manganese.

Comparative Health of Cities.

The Health Bureau of the German Empire reports that during the week ending on the 27th of January last, the number of deaths to every hundred thousand of the inhabitants in the cities enumerated were as follows:

Berlin	42	Copenhagen	58
Cologne	52	Stockholm	55
Magdeburg	56	Christiana	45
Strasburg	76	Warsaw	28
Munich	60	Naples	61
Augsburg	89	Turin	43
Dresden	38	Bucharest	59
Leipzig	34	London	40
Brunswick	41	Liverpool	55
Hamburg	48	Glasgow	49
Vienna	52	Dublin	58
Pesth	81	Edinburgh	41
Prague	95	Alexandria, Egypt	85
Amsterdam	56	Madras	121
Rotterdam	51	Bombay	65
The Hague	44	New York	47
Basle	65	Philadelphia	32
Brussels	49	Boston	37
Paris	53	San Francisco	58

Five Thousand Dollars Reward for a New Invention.

The Directors of the London General Omnibus Company offer to award a prize of £1,000 for an invention or a scheme for effectually recording or checking the receipts of their passengers' fares, and which may be accepted by them as being so effectual. But the acceptance of any invention or scheme is to be entirely in the discretion of the directors, who will not be bound to accept any invention or scheme at all, nor to give any reason for non-acceptance.

To Polish Watch Wheels Without Injuring Them.

Take a flat burnishing file, warm it over a spirit lamp, and coat it lightly with beeswax. When cold, wipe off as much of the beeswax as can be readily removed; and with your file thus prepared, polish the wheel, which should rest on a piece of cork. The finish will be of the finest kind, there will be no clogging, and the edges of the teeth, etc., will remain perfectly square.

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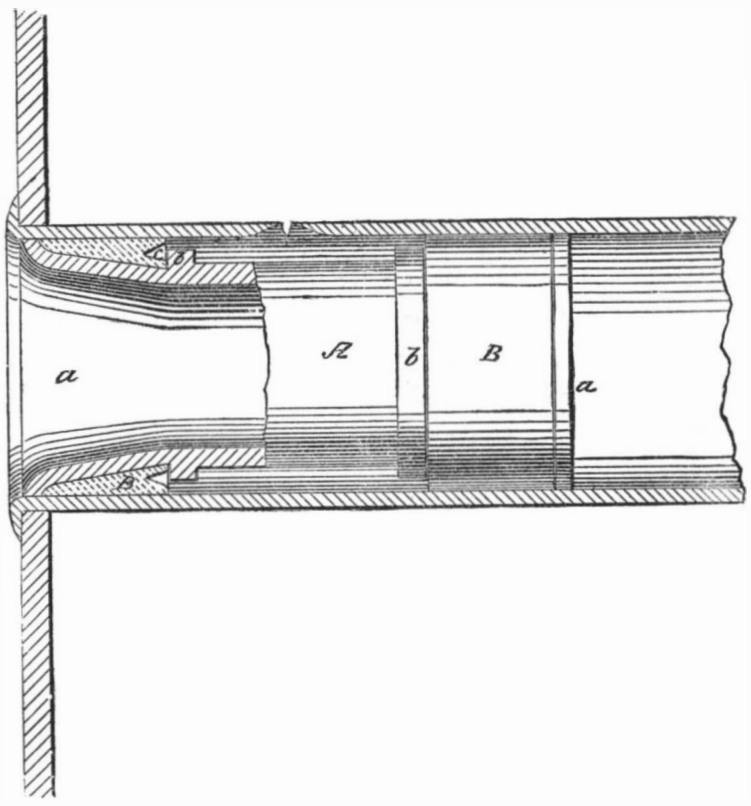
NEW MODE OF STOPPING LEAKS IN BOILER TUBES.

Mr. John McConnell, of Glasgow, Scotland, has patented through the Scientific American Patent Agency a device for stopping leaks in boiler tubes, which he claims may be placed in the tube when the boiler is under full working pressure, and without impairing the efficiency of the tube, as shown in the engraving. A is a tube of iron or other suitable material, which is bell-shaped at each end, *a*, and is provided with the collars, *b*, which surround the tube at the juncture of the bell-shaped and straight portions, and are somewhat less in diameter than the interior of the tube to which the stopper is applied. B B are gaskets of rubber, which have a form adapted to the space between the bell-shaped portion of the tube and the inner surface of the boiler tube, and are provided with a V groove, C, in their thicker or inner edges. The stopper is applied to the boiler tube by moving it by any convenient means to the leak, and placing it so that one of the collars, *b*, is on each side of the leak, as shown: when the pressure of the steam or water will force the rubber rings, B B, outward, and throw the lips or flanges formed by the grooves, C, against the inner surface of the boiler tube and the stopper, thus confining the leakage to the small annular space that surrounds the stopper.



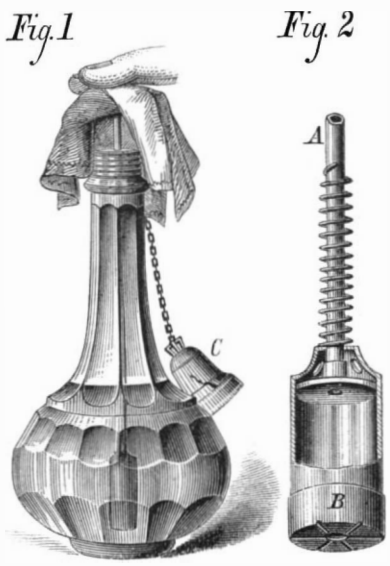
McCONNELL'S TUBE LEAK STOPPER.

Hydriodate of Morphine.

This new compound, which permits of being used in medicine, has been prepared by Ernst Schmidt both by dissolving morphine in hydriodic acid and by the action of acetate of morphine on iodide of potassium. The product in both cases was identical. Both crystallize in long needles, with silky luster and grouped in rosettes. The composition is represented by the formula C_{17} H_{10} NO_3 H I, and $2H_2$ O. When heated to the temperature of boiling water, it loses the two molecules of water, but recovers them on exposure to the air. It is but slightly soluble in cold water, more so in hot water. The hydrobromate of morphine is very similar to the above, crystallizes like it, and the crystals also contain two molecules of water.

A NEW PERFUME BOTTLE.

The annexed engraving represents an ingenious little novelty designed for attachment to perfume bottles. It is not an atomizer, but rather a miniature submerged pump, which, on being operated, forces up a small jet of the liquid against the hand or handkerchief. The stopper of the bottle, Fig. 1, is arranged in any convenient way to allow the passage of a hollow piston rod, A, Fig. 2, which terminates in a piston inclosed in the case, B. The latter is simply struck, in two portions, out of their metal, and has apertures above and a simple valve below. The piston rod is sustained by a spiral spring, and terminates above in a hollow button in which a



hole is made. On pressing on the button, the piston is forced down, the valve in the bottom of the case, B, closes, and the liquid beneath the piston is driven up through the hollow rod and emerges in a fine jet from the button. There is a screw thread on the bottle or stopper to receive the cap, C, for covering the button during transportation.

The advantage of the device is that it prevents waste of the perfume, which is the case when the contents of a bottle is shaken carelessly on the handkerchief, or when the bottle is left unstoppered. It is also a convenient arrangement for the toilet table, as a slight touch on the button causes the escape of a supply without lifting the bottle. The metal parts can be cheaply made by machinery, so that the dealer can sell bottles of perfumery provided with the device at quite a small additional price.

Patented through the Scientific American Patent Agency, January 14, 1873. For further particulars relative to sale of patent, address the inventor, Mr. W. S. Ward, P. O. Box 4,175, New York city.

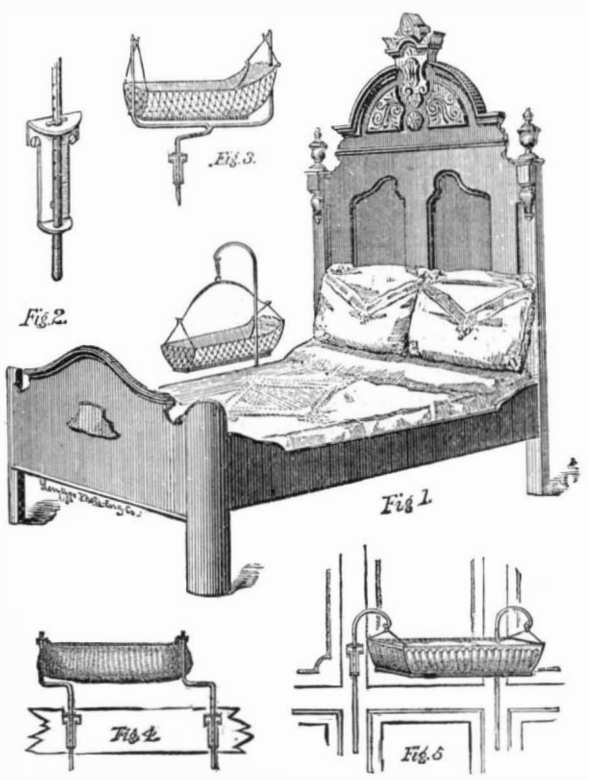
PROFESSOR MARSH, of Yale College, has received from the Geological Society of London a medal known as the Bigsby Medal, accompanied by a letter speaking in flattering terms of his recent discoveries among the fossils.

Learn the Value of Money.

A silver dollar represents a day's work of the laborer. If it is given to a boy, he has no idea of what it has cost, or of what it is worth. He would be as likely to give a dollar as a dime for a top or any other toy. But if the boy has learned to earn his dimes and dollars by the sweat of his face, he knows the difference. Hard work is to him a measure of values that can never be rubbed out of his mind. Let him learn by experience that a hundred dollars represents a hundred weary days' labor, and it seems a great sum of money. A thousand dollars is a fortune, and ten thousand is almost inconceivable, for it is far more than he ever expects to possess. When he has earned a dollar, he thinks twice before he spends it. He wants to invest it so as to get the full value of a day's work for it. It is a great wrong to society and to a boy to bring him up to man's estate without this knowledge. A fortune at twenty-one, without it, is almost inevitably thrown away. With it, and a little capital to start on, he will make his own fortune better than any one can make it for him.—*Hunt's Merchants' Magazine.*

ROBERTSON'S CRADLE ATTACHMENT FOR BEDSTEADS.

The annexed engraving represents a novel mode of attaching an infant's cradle to a bedstead. One form of the invention consists in the use of a bracket, Fig. 2, attached to the inside of the bedstead rail or other convenient place, and provided with holes at top and bottom, through which passes the lower end of a rod having its top curved so as to support the cradle, as shown in Fig. 1. When arranged in this manner with a single rod, the cradle may swing either lengthwise or sidewise; or, by allowing the rod to turn in the bracket, the cradle may have a horizontal, rotary, or semi-



rotary motion imparted to it. By means of a spring interposed between the curved arm and the bail, a jumping motion may be given to the cradle if desired; or the bail or support may be made flexible for the same purpose.

Instead of the single vertical support shown in the main figure, a forked one, such as is shown in Fig. 3, may be used, in which case no bail is required for the cradle, thus leaving it entirely clear at the top; or two supporters—one at each end—may be employed, as in Figs. 4 and 5, when the child grows too heavy for a single support.

One advantage possessed by the single or forked standards is that they may be readily turned so as to swing the cradle either over the bed or on the side of the bedstead, or crosswise, as desired. When in the last position the cradle may be tipped on one side and so held by a hook (not shown), and the child may then receive its nourishment without the mother feeling its weight or heat, which, in warm weather, is a great relief to mothers.

Instead of attaching the brackets to the side of the bedstead they may be fastened to the footboard, and the cradle is then entirely out of the way in getting into bed, and takes up little space that can be occupied by other furniture.

It is often desirable to remove the cradle from the bed room to some other. This may be readily done by attaching to any convenient woodwork, such as the chair or base boards, wainscoting, etc., a bracket or brackets, as shown in Fig. 5; or the bracket on the bedstead may be readily slipped from its fastenings and as easily secured in the desired position. The bracket and rod may be further utilized by hanging a baby-jumper from it when the cradle is removed.

This invention was patented September 17, 1876, by Mr. T. J. W. Robertson, 820 F street, Washington, D. C., to whom applications for further information, or for State, county, or shop rights, or licenses to manufacture on royalty, should be made.

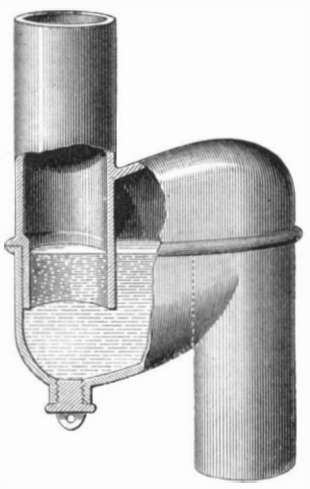
Make Something: Produce Something.

Half the people of the world are idle for want of some overseeing eye to set them to work. The advice which Haydon gave to the erratic poet Keats, to settle down to some definite purpose, needs be given to almost one half of mankind. There are very few persons but would find themselves comfortably well off if they would take hold of any one of a hundred pursuits and stick to it. Industry and economy will make a most wonderful change in many households. So says one of our exchanges, and we believe it is the truth.

ADEE'S IMPROVED TRAP.

In the annexed engraving is represented a very simple trap for soil pipes, drains, etc., which is claimed to completely prevent the backing-up of sewer gas. The ordinary bent pipe trap is not, as a rule, an efficient protection against this exceedingly dangerous emanation, because the discharge of the contents of the drain frequently creates sufficient suction to draw the water which forms the seal below its proper level in the bend. When this occurs, no obstacle whatever is presented to the escape of gas, and the trap may as well be absent altogether.

In the present device the body is made about two and a half



times as large in capacity as the part of the outlet pipe which enters it. Hence the weight of the water contained prevents the seal being broken by suction or siphonage, because it requires a greater force to lift the water than it does to draw air through it. In event of back pressure, the trap will resist about two and a half times as much as the old bent pipe trap. This is evident from the fact that the pressure is distributed over so large a surface of water. If the level of the latter is depressed one half inch in the trap, as a matter of course the level in the upper limb is raised one and a quarter inches. In this way the depth of the seal is increased instead of diminished; and when the pressure is withdrawn, the water naturally falls back to its original depth of seal, which, in this trap, is always one inch.

Patented June 13, 1876. For further particulars, address Messrs. Frederick Adee & Co., 275 Pearl street, New York city.

BITUMINOUS MACADAMIZATION.—In the Faubourg Poissonniére an experiment new to Paris is being tried in road making. The road is laid with broken stones and pebbles, and the whole held together with asphalt or bitumen. The asphalt is allowed to cool, and the material is subjected to a powerful pressure from a steam roller.

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THE CITY OF FLORENCE, ITALY.

No city in Italy is more attractive to the tourist than Florence. Rivaling Rome in its art galleries and libraries, it has the renown belonging to the commercial metropolis of the middle ages; and the spirit of independence of its citizens long kept the city free from princely and ecclesiastical tyranny, and made it the seat of culture, learning, and refinement for the whole peninsula.

We publish herewith views of two of the most celebrated buildings in Florence. The first is the Palazzo Vecchio, erected in the year 1298 for the use of the Gonfaloniere and Magistrates of the Republic of Florence. For many ages, it formed the center of the political life of the Florentines. A magnificent staircase leads from the court to the vast hall where Savonarola convened the citizens in his futile attempts to restore to them their ancient liberties. This hall, now somewhat dilapidated, was used for the meeting of the Italian deputies before the removal of the seat of government to Rome. The Palazzo Vecchio contains a large collection of pictures, among which are numerous portraits of great historical interest; and in front of the building, in the open air, are several of the finest statues that the Renaissance period produced. Among them are the David of Michael Angelo (considered by many to be his masterpiece), the Rape of the Sabines by John of Bologna, and the Perseus of Benvenuto Cellini.

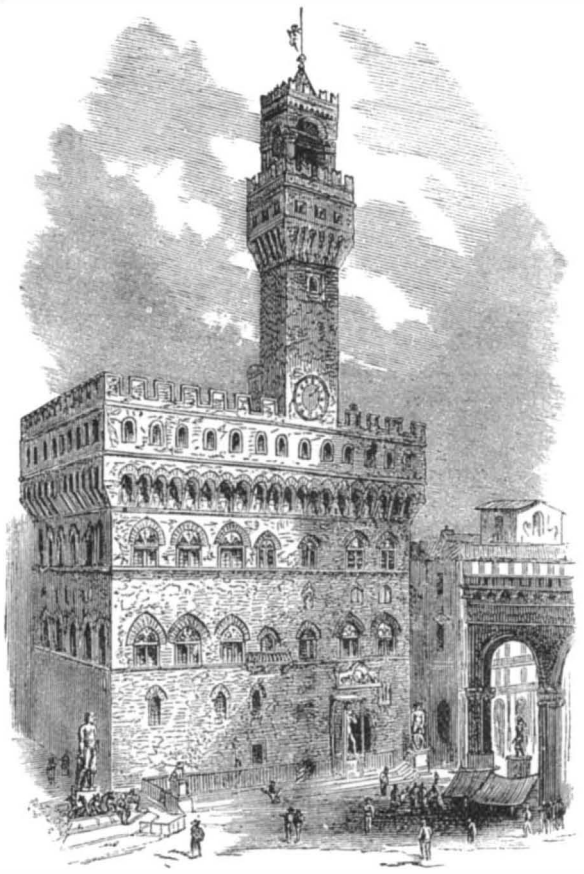
Our second engraving shows the Cathedral with the Campanile designed by Giotto. The great dome, the largest in the world, is the creation of Brunelleschi; and Michael Angelo, when on his way to Rome to undertake the erection of the basilica of St. Peter, is reported to have said that it was not possible to surpass the great work of Brunelleschi. The interior of the Cathedral is at first view disappointing, as the walls are sombre and colorless. But by degrees the simple purity of the proportions and the grand sweep of the dome impress the spectator; and the richly jeweled windows, which at first are overlooked on account of their smallness, soon attract the eye and add to the general effect.

The Campanile is the pride of Florence, and concerning it Mr. Ruskin says: "The characteristics of power and beauty occur more or less in different buildings, some in one and some in another. But all together, and all in their highest possible relative degrees, they exist, as far as I know, only in one building in the world—the Campanile of Giotto, at Florence. I remember well how, when a boy, I used to despise that Campanile, and think it meanly smooth and finished. But I have since lived beside it many a day, and looked upon it from my windows by sunlight and moonlight, and I shall not soon forget how profound and gloomy appeared to me the savageness of the Northern Gothic, when I afterwards stood, for the first time, beneath the front of Salisbury Cathedral. The contrast is indeed strange, if it could be quickly felt, between the rising of Salisbury's gray walls out of their quiet swarded space, like dark and barren rocks out of a green lake, with their rude, mouldering, rough-grained shafts, and triple lights, without tracery or other ornament than the martins' nests in the height of them, and that bright, smooth, sunny surface of glowing jasper, those spiral shafts and fairy traceries, so white, so faint, so crystalline, that their slight shapes are hardly traced in darkness on the pallor of the eastern sky, that serene height of mountain alabaster, colored like a morning cloud and chased like a sea shell."

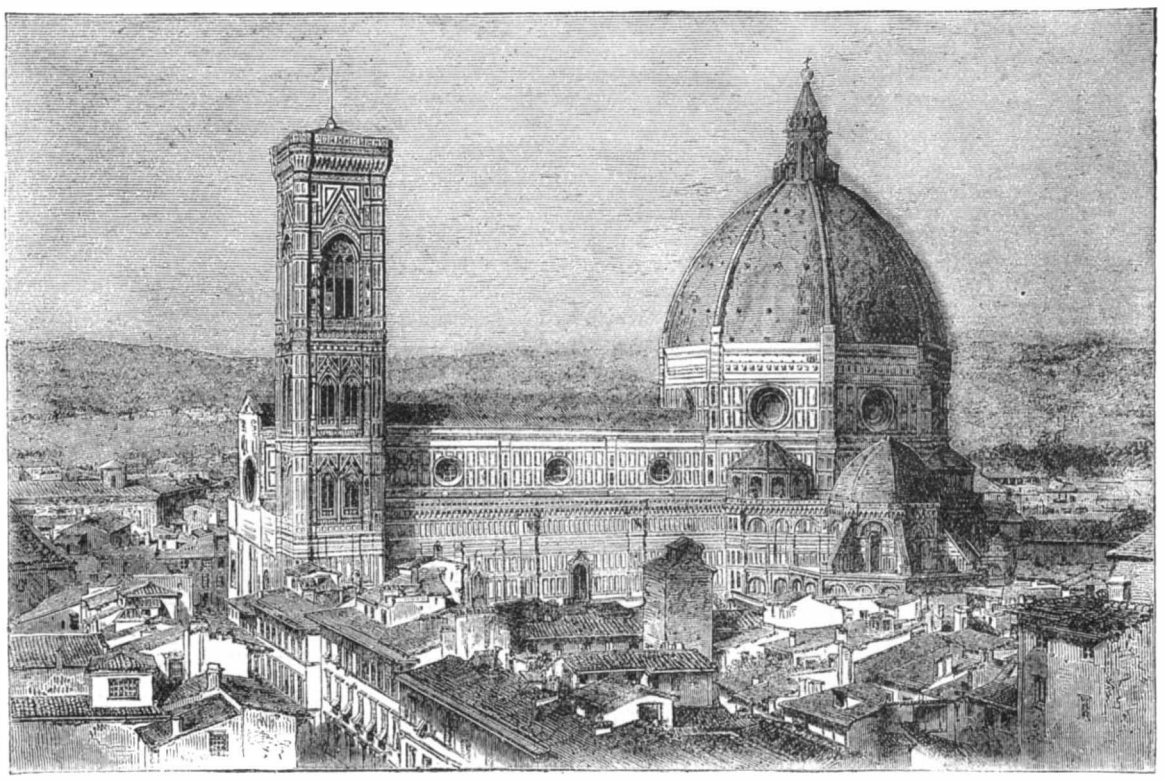
The wonderful tower which has drawn such commendations from the most captious, acute, and sensitive of art critics, was the work of an artist whose early life was passed in the fields, herding sheep. Cimabue was his preceptor, having seen a rough sketch drawn by the shepherd boy. It was simply the figure of a sheep, scratched upon a piece of slate; but it showed such acuteness of observation and ability to portray expression that Cimabue took the young artist into his house and taught him painting. Giotto lived to eclipse his master and to assist Italian art to free itself from the trammels of the Byzantine style. Many of his works are now lost; but his skill and penetrating observation are shown in those which remain, and it is easy to account for his influence over the artists of his time, from Padua to Naples.

There is in St. Peter's, at Rome, a wonderful mosaic picture of Christ stilling the waves of the sea, by Giotto; but it has been so much repaired that little of the original now remains. In Padua he executed a series of paintings, forty-two in number, illustrating the life of the Virgin Mary. To his friendship for Dante may be attributed the allegorical tendency of many of Giotto's works. The wonder and enthusiasm which his works excited has not been paralleled, even in the history of Italian art; and his influence in the art world lasted for a century after his death.

Near the Duomo in Florence is the Baptistery of St John, in which are two bronzed doors, by Ghiberti, which are marvels of art. Michael Angelo declared them worthy to be the gates of Paradise. Not far off is the church of San Lorenzo, with the Chapel of the Medici, in which are Michael Angelo's statues of Day and Night, and of Giuliano and Lorenzo de Medici. Probably in no city in the world are so many masterpieces of genius and skill to be found within a few feet of each other.



THE PALAZZO VECCHIO, FLORENCE.



THE DUOMO AND CAMPANILE, FLORENCE.

Titanium Chloride for Prisms.

In optical experiments and in spectroscopic work, hollow glass prisms filled with bisulphide of carbon are frequently employed because of the high refractive power of the bisulphide. It possesses, however, several disadvantages, among which are its odor and its wonderful solvent properties. The hollow glass prisms employed are nicely ground to the proper angle and plates of glass cemented thereon. The bisulphide of carbon attacks the cement, whatever it may be, and in most cases soon causes the prism to leak. This necessitates the removal of the liquid after using and refilling the prism each day when it is to be used. Cannot some other dense and highly refractive liquid be substituted for it?

It is our wish to call attention to another liquid of very high refractive power, almost equal to bisulphide of carbon, that may perhaps be substituted for it, as it is free from this solvent action, at least on some substances. Titanium chloride fumes in the air, sending off great clouds of white smoke, and is consequently a disagreeable substance to handle. It has, however, the property of remaining in a bottle or other vessel, even when loosely stoppered, for the reason that the fumes of oxide and oxychloride collect about the cork and in all other crevices, completely closing them.

Titanium chloride is prepared in a manner totally analogous to that employed in the chlorides of silicon, aluminum, and some similar substances, namely, the action of dry chlorine gas upon a mixture of titanium oxide and lamp black at a high temperature. Although a difficult laboratory experiment, it might be produced on a large scale almost as easily as chloride of aluminum, if the demand for it were sufficient.

Potassium Xanthogenate as an Antiseptic.

Not long since we recorded the discovery of remarkable antiseptic and conservative properties in the well known bisulphide of carbon. Unfortunately this substance is exceedingly offensive to smell and taste, poisonous, combustible, and even explosive if mixed with air. If, however, it be mixed with an alcoholic solution of caustic potash, it combines with these substances to form a crystalline substance known as xanthogenate of potassium. This latter salt is quite as powerful as the more offensive bisulphide of carbon.

Zöller, in a letter to Professor Hofmann, states that the antiseptic properties of potassium xanthogenate are certainly not surpassed by those of any other known substance. Even human urine was protected from mould and putrefaction for a long time by the use of a small amount of this substance. A very small quantity of it has kept plant juices and extracts for eight months, whether closed or open, no mould or decomposition taking place, nor is the taste affected, and they can be taken without injury. At the beginning of October, Dr. Grote added some of this salt to wine must, and at the end of three months the must preserved the flavor and sweetness of the fresh juice. Several persons partook of considerable quantities of this preserved drink without suffering any inconvenience. Dr. Zöller expresses the belief that the xanthogenate will become naturalized in every household on account of its cheapness, ease with which it can be used, non-poisonous qualities, and the small quantity required for the purpose.

Xanthogenate of potassium may be employed in medicine, both externally and internally; and to avoid the action of potassium on the system, the xanthogenate of sodium could be used for medicinal purposes.

How to Make Printing Plates by Photography.

M. Boivin, who is perseveringly pursuing his labors and interesting researches, has written a description of a very facile process to obtain engraved plates capable of being printed in an ordinary printing or engraving press. Unfortunately it is impossible, so far, to reproduce half tones by these means; but nevertheless, the process will be valuable for reproducing linear designs and sketches. When it is desired to produce a block or printing plate in relief, a sheet of zinc or copper is taken, $\frac{1}{8}$ or $\frac{1}{5}$ inch in thickness. After having grained the surface, it is coated, in a warm condition, with a light film of wax. To this film you transfer a carbon print by ordinary means, and having developed it, it is dipped into alum solution, and dried. Then the plate is plunged into some solvent of wax—benzole, for instance—and in this way those portions of the metal surface not covered by the image are laid bare, ready to be etched with acid; the layers of wax and carbon in the other parts are sufficient protection against any mordant that may be used. It need scarcely be said that, when blocks for the printing press are desired, a negative cliché must be made use of; while in that produced off a plate to be printed in an engraving press, a positive image must be employed. Nevertheless, an ordinary negative may also be employed in the latter case; only, if this is done after having produced the carbon picture, the plate must be covered with a film of copper by the electrotype process. The image may be removed by hypochlorite of lime and boiling water, and then the wax with benzole, and finally acid is employed to etch. In the latter case the copper constitutes the reserve, while the bare zinc plate is etched by the acid. The success of this process of photo-engraving is assured, according to M. Boivin, if use is made of very clear negatives, presenting opaque blacks and whites free from fog. It is indispensable, also, that the pigmented tissue has never been exposed to light previously. M. Boivin finds that the employment of wax is more facile than that of asphalt dissolved in the benzole, recommended by M. Markl for an analogous process.—*E. Lacan, in Photographic News.*

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The Treatment of Iron for the Prevention of Corrosion.

Professor Barff recently discoursed on the above subject in a lecture delivered before the Society of Arts, London. He said: "While experimenting, two or three years ago, with my friend, Mr. Hugh Smith, on different methods for preventing incrustation and corroding of steam boilers, I was led, through the failure of all the processes employed, to believe that, if it were possible to convert the surfaces of iron plates into the magnetic or black oxide of iron, in such a manner that the particles of black oxide formed in the position of the original particles of iron could be rendered perfectly adherent to the iron surface, which does not become peroxidized, and perfectly coherent with one another, the object would be effected. I do not intend to enter into the chemistry of the oxidation of iron to its full extent; it would take too much time, and it would rather tend to confuse than to enlighten those who are not well up in their chemistry, and would raise questions which would bring on prematurely a collision with the views of some of my brother chemists: which collision, under suitable circumstances, at some future time not very remote, I look forward to with considerable satisfaction, as it will be the means of solving many phenomena which have never yet been explained. A piece of dry iron, its surface being polished, may be exposed for any length of time to dry air without rusting, but it begins to rust at once as soon as the slightest moisture comes in contact with it. We have to consider only two oxides of iron: one containing 56 parts by weight of the metal to 16 parts of oxygen, and the other containing twice 56 parts of iron and three times 16 parts by weight of oxygen. We speak of these oxides as the protoxide and sesquioxide, or as ferrous and ferric oxide.

"Immediately the protoxide is formed, it being more moist, it unites with oxygen and becomes gradually converted into the ferric oxide. Now, let us suppose a moist iron plate to come into contact with oxygen. It is clear that the protoxide will be first formed, and this rapidly becomes converted into the higher oxide. Now, suppose you take a solution of the salt of the higher oxide and put into it metallic iron; in time, the air being excluded, this higher salt will become converted into a salt of the lower oxide. Let us now see how this bears upon the rapid oxidation of iron in the presence of moisture. We have seen that when oxygen comes in contact with moisture the first oxide is formed and becomes rapidly oxidized into the higher one. But this higher oxide is in contact with metallic iron, which will reduce it to the lower oxide, thus becoming oxidized by the oxygen which it has taken up from the higher oxide. You will now see clearly how it is that iron rusts throughout its whole substance with such rapidity, for the oxide of iron serves as a carrier for atmospheric oxygen to the iron to almost any depth. There is another oxide of iron, called the black or magnetic oxide, containing three times 56 parts by weight of iron and four times 16 parts by weight of oxygen. Some chemists consider this oxide to be a sort of mixture of the two others, and they call it ferroso-ferric oxide; whether this be the case or not does not matter to us this evening. But it is a most important point for our consideration, that this oxide undergoes no change whatever in the presence of moisture and atmospheric oxygen. Nor does any temperature to which it can be exposed, in any of the ordinary uses to which iron is applied in the presence of moisture, either decompose it or produce its further oxidation. In every school where chemistry is taught, in the most elementary lecture on hydrogen, the pupils are told that, if they pass steam over red-hot filings contained in an iron tube, they will be able to collect and burn hydrogen gas at the opposite end of the tube to where the steam enters. For a long time it was thought that the particles of black oxide formed by this decomposition of the steam were pulverulent, and could not be made to cohere into a solid mass. The result of a considerable number of experiments has been to prove that they can be made not only coherent amongst themselves but adherent to the body, and that both these produce a proper formation of this black oxide on the surface of iron plates; for, as I will show you later on, the oxidized surface of the iron resists for a long time, and more effectually, the rubbing with emery paper, than does the simple metallic iron itself, and that there is a very manifest difference between the ease with which a sharp rasp is able to cut away the surface of the iron and the difficulty with which this black oxide is removed from the surface by that same instrument. The method, which long experience has taught us is the best for carrying out this process for the protection of iron articles in common use, is to raise the temperature of those articles, in a suitable chamber, say to 500° Fah., and then pass the steam from a suitable generator into this chamber, keeping these articles for five, six, or seven hours, as the case may be, at that temperature in an atmosphere of superheated steam. I will presently call your attention to the diagram of the furnace and muffle which I have employed in all our later experiments, and in which all the specimens before you, which will be alluded to in this paper, were prepared. Differences of temperature are employed where different objects are to be obtained. If it be wished to act upon surfaces of polished iron or steel, it is desirable to let the temperature remain at 500° Fah. until the operation is completed. Articles coated in this way will not resist the action of continued moisture, such as has prevailed for the last two months, when exposed out of doors; but they will resist the action of any amount of moisture with which they may come in contact in a house or building; and the reason of this will be very obvious, because only a thin film of the iron on its surface is transformed into the black oxide. This I will explain more fully to you when I call your attention to individual specimens. At a temperature of 1,200° Fah., and under an exposure to superheated steam for six or seven hours, the iron surface becomes so changed that it will stand the action of water for any length of time, even if that water be impregnated with the acid fumes of the laboratory. Before calling your attention to our failures and successes as they lie before you on the table, I will just allude to a few of the uses to which this process may be, as I consider, successfully applied—to water mains, also to water-connecting pipes, as well as to the water pipes used inside the house, which, in this case, would supplant their leaden predecessors. In this hall of hygiene, these words will, doubtless, sound as sweet music to the ears of many of those who have honored me with their attendance this evening. The greatest objection to the use of iron pipes for the supply of water in houses hitherto has been this: that by rusting they caused the first quantities of water drawn off in the morning to be dirty and turbid; now this will be entirely prevented if the pipes be first exposed to the treatment which I have just explained to you—of course gas pipes could with advantage be similarly acted upon—and as the surface, when oxidized, is harder than the natural surface of the iron, the friction of large bodies of water through the pipes, and the friction necessarily employed in fixing them in their places, would be much better resisted than by the untreated iron itself. I cannot overestimate the advantages which the employment of this process must confer on architects, who will be by it enabled to employ iron, whether wrought or cast, much more largely, not only in the decoration but in the construction of their buildings. Last summer I was at a very large house in the country where the entrance portico, some twenty feet high, was being painted and decorated, when one of the large plaster ornaments of the ceiling broke away from its holdings, and would have fallen to the ground except that it was caught by a workman. This ornament weighed not less than twenty-five pounds, and if it had fallen from this height upon the workmen below it must have killed them. The ornament had been there many years, and was fixed up in the best method possible, it being supported and secured by iron rods. On examination I found that these rods were rusted through completely to the very center. I need not make any comment upon this, since I have been able to introduce you to iron treated in such a way that it will never rust. Of course, if the process will answer for architectural ornaments, it will answer for statues, so that iron may be used instead of bronze, which will materially lessen the cost of casting statues, both in the material and in the expense of making the moulds. You well know that when a tinned saucepan is allowed to get dry on the fire and burns, as the servant calls it, so that it is rendered useless until it is tinned again. Now, if such a saucepan be treated by the method I recommend, it may be allowed to get red hot without suffering injury, for the protection on its surface is produced at a red heat. We have experimented on some screws, hinges, locks, keys, bolts, with complete success. It has been suggested to me that the iron nipples used in gaslights would not corrode, and would, therefore, be more useful, if submitted to this action of superheated steam. Wherever iron is used, railings, street gas posts, iron safes for keeping documents fireproof and thief-proof, the framework of filters, tanks, cisterns for domestic and other uses, iron employed in the erection of temporary buildings—which I flatter myself, if treated by this process, would become permanent buildings—all these, and many other applications of iron to the arts, would immensely gain by being submitted to this oxidizing action. I think I need hardly take up your time by enumerating other applications for the preservation of iron, for it appears to me that they would be commensurate with most of the uses to which iron is applied, save and except those where friction—such as that to which rails and iron wheels are exposed—would necessarily wear away the coating, as they wear away the material itself. I am happy to see a namesake of mine here present this evening, who will tell you that he is carrying out a process for the manufacture of peat into charcoal by the action of superheated steam, and that he is enabled, by superheated steam alone, to raise the temperature of his chambers to a red heat, quite sufficient to effect his carbonizing process."

Planting Trees for Profit.

A correspondent of the *Ohio Farmer* thinks that trees "can be grown as easily as corn," and also, under some circumstances, with considerable profit. An acre of soft maple trees planted in rows 8 feet apart, with the trees two feet in a row, would prove a remunerative venture, as ten trees, twelve years old from the seed, will make a cord of wood. The writer gives some interesting examples as follows:

"One of my neighbors, in the spring of 1850, started a locust plantation of some acres on rather thin land; he planted the seed in hills four feet apart each way. The seed was prepared by pouring boiling water over it; and after it was swelled plump, several seeds were dropped in each hill. The seed came up well, and the plants were cultivated for two or three years. As soon as they were large enough for bean poles, he began to thin them out, and afterwards, again, for fence stakes. In eighteen years he cut them off clean and sold them for posts, receiving several hundred dollars per acre, and paying off a mortgage on his farm. They are now growing much faster than before, and in about twelve years from the former cutting will be as large as they then were. On another farm in my neighborhood there was growing, when I moved here in 1848, a double row of locust trees that had been set out to shade a short lane. There were forty trees in two rows, four feet apart, and the trees stood from four to eight feet apart in the row, allowing one rod in width; the ground occupied was one tenth of an acre. When these trees were twenty-five years old, they were cut, and made 400 first-class posts (averaging ten to the tree), and the wood and fence stakes made from the limbs more than paid for the work of cutting and splitting. It is now nine years since the original forty trees were cut, and I find nearly 300 trees have come from the stumps and roots to take their place; 180 of these are now nearly or quite large enough at the butt for posts, and, from the present rate of growth, I am satisfied that, in fifteen years from the former cutting, they can be cut again and make over 1,000 posts, and at the same time leave 100 or more trees growing that will be from four to six inches in diameter.

"Under any possible circumstances, timber must command high prices in the future, and I believe that those parents who wish to make an investment for their children, combining perfect safety with a certainty of profit, cannot do better than to plant timber; it will require no care after it is started, and cannot fail to be profitable."

The Uses of Evergreens.

We extract the following from an address recently delivered by the Hon. H. W. Lord, at Pontiac, Mich.:

Within the last twenty-five years evergreens have greatly multiplied, during which time many new varieties have been introduced; nurserymen have learned to propagate them cheaply, and in such manner that they may be transplanted with certainty, so that they are within the reach of all who have grounds on which to plant them, and with taste and usefulness. Now one cannot travel far through the country without finding here and there fine displays of them, adorning and sheltering the homesteads of the farm as well as the urban and suburban dwellings.

Some ten years ago the writer purchased of a nurseryman at Detroit 1,000 little white cedars, the *arbor vitæ*; the plants were one year old from the seed, about six inches high, and cost one and a half cents each—$15 per thousand. Besides planting many of them in groups or singly about the house and grounds, a sufficient number were used to make a hedge or screen on the westerly and northerly sides of a large garden which had been very much exposed to the sweep of blasting winds, sometimes to the destruction of nearly all the early plants that it contained. These cedars, set out some two or three feet apart, all grew luxuriantly, and they now form a living wall about twelve feet high, as impervious to the winds as if built of brick or stone, affording a complete protection to the garden, and more than doubling its value for the purposes of its use. Delicate plants, that one blast of cold wind in a May morning would chill and destroy, now, no matter how bleak the gusty day, seem to nestle in the warm sunshine, unconscious of harm.

This is a cheaply obtained refuge that one may profit by, and an inexpensive ornamentation in which one may indulge. When rough wintry tempests seem to shake the earth, when you hear them howl about your window panes, driving December rains almost through them, when your fires burn briskly, but do not warm your house: then you may reflect that, had you a few years before planted your grounds thickly with a variety of evergreens, in the direction whence come the prevailing storms, the trees would overtop your dwelling and afford you a "hiding place from the wind."

If, in the place of our fences, all the roadsides, and the dividing lines between all fields or divisions of ownership, were lined with rows of evergreens twenty to fifty feet high, it is probable that we should hear no more of winter killed wheat, or very little. The expense would be small in the first instance compared with fencing. Ten evergreens to the rod would be sufficient, and would cost fifteen cents, and the labor of planting about as much more. But how about the cattle? Well, that is a question of considerable magnitude. It is our opinion that they should never be allowed to leave the inclosures provided for them about the barns and sheds.

It is not likely that many in this hall will live to see the day, yet we believe it is not very far distant, when there will be no fences in Michigan, except those provided to keep animals away from the fields, rather than to confine them in them. Farmers themselves, severely as they feel the weight of their expenses for fences, are as a rule unaware of the enormous burden of them, and how much it costs to perpetuate the incumbrance. If to the westward and northward of each farmer's farm and cattle yards a belt of evergreens were planted, they would in ten years form as complete a protection as a stone wall fifteen feet high, and be better every way, affording a hiding place from the winds, that sweet-breathed cows, and oxen, and gentle sheep would regard as a special providence, and for which they would repay their owners many fold. Belts of evergreens planted on the exposed sides of orchards afford such a hiding place from the winds that trees so protected have been observed to be fruitful, when others in bleak situations have utterly failed.

When these truths shall be fully appreciated, and the further truth that every three acres will sustain as much stock in the yard as five acres will in the field, then farmers will begin to inquire if fences cannot be dispensed with; and when they shall realize how destructive to crops it is to let the winds go wholly at large, then they will begin not only

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to decorate and adorn their homes and gardens with evergreens, but will extend them along the highways, and make landmarks of them between all neighboring possessions and property.

Is it a New Element?

Dr. George A. König, of the University of Pennsylvania, recently announced the discovery of what he thought to be a new metal. If this proves true, America may have the honor of celebrating her centennial year by the discovery of a new element in a peculiarly American mineral. Dr. König states that in analyzing a mineral resembling schorlomite, brought from Magnet Cove, Arkansas, by Professor A. E. Foote, he obtained, in the place of titanic acid, a white oxide which differed from the former very materially. Inasmuch as Dr. König does not tell us wherein these differences consisted, we can scarcely form an opinion on the probability of this being the oxide of some new metal. The oxide of titanium is itself white, when pure, and possesses many remarkable properties, such as existing both in a soluble and insoluble form, of passing from the former to the latter condition simply by continued boiling, of passing gradually into that state by standing, that it is precipitated pure by ammonia in the presence of sulphurous acid, sulphureted hydrogen, or other reducing agents. The numerous forms in which it appears, and its protean changes, would be likely to deceive a less experienced chemist than Dr. König, who has already discovered one new mineral, a hydrated oxide of titanium, to which he gave the name of hydrotitanite.

In M. Mendelejeff's remarkable prediction of the discovery of gallium from a mathematical comparison of the atomic weights of the known elements, he also predicted the discovery of another element to which he gave the name of eka-silicon, or eka-silicium, having its place between silicon and titanium. Perhaps Dr. König has discovered eka-silicium.

The new element, which Mendelejeff called eka-silicium, will be obtained, says he, from its oxide EsO_2, or the potassic fluoride EsK_2F_6, by means of metallic sodium. The metal will decompose steam with difficulty, acts feebly on acids, more easily on alkalies. It will be a difficultly fusible metal of a dark gray color, which when ignited is converted into an oxide, EsO_2, which fuses with difficulty. The specific gravity of the oxide will be 4·7. It will resemble in external appearance, probably also in crystalline form, in properties and reactions, oxide of titanium, TiO_2. As the acid characters of the oxides of titanium and tin are feeble, although distinct, the new element will possess the same characters and be a stronger acid than titanic oxide. It will bear the same relation to titanium as zinc to calcium, and as arsenic to vanadium; so its basic properties will be more feeble than those of the oxides of titanium and of tin, but stronger than silica, SiO_2. We may expect it to form a hydrate soluble in acids, the solution being easily decomposed with the separation of an insoluble metahydrate. It will be more easily separated from acid solution than TiO_2, less easily from alkaline solution. There is no doubt that it will form with corresponding salts of silicon, titanium, zirconium, and tin, isomorphous double fluorides. The potassic fluoride will be more soluble than the corresponding silicon salt. The chloride of the new metal will have the composition $EsCl_4$, will boil at 212° Fah., or perhaps lower; its vapor density will be about 1·9 at 32° Fah. It will form, like silicon and tin, a series of volatile metallo-organic compounds, which will distinguish it from the chloride of titanium.

If Dr. König has not really discovered this expected metal, its discovery is not distant, for many of our American chemists are earnestly engaged in hunting it down, and with our vast mineral resources, and the Russian chemist's explicit directions of where and how to look for it, we anticipate speedy success.

Mendelejeff's remarkable prediction of gallium was the result of what he calls the periodic law. His table, from which he obtained his results, and the study of which will probably lead to many other interesting discoveries, having never before been printed in English, is given below:

MENDELEJEFF'S TABLE OF ELEMENTS.

	Group I.	II.	III.	IV.	V.	VI.	VII.	VIII. Transition to group I.
Typical Series...	H=1 Li 7	Be 9·4	B 11	C 12	N 14	O 16	F 19	
Series 1	Na 23	Mg 24	Al 27?	Si 28	P 31	S 32	Cl 35·5	
" 2	K 39	Ca 40	Ga 44	Ti 48	V 51	Cr 52	Mn 55	Fe 56, Co 59, Ni 59, Cu 63.
" 3	(Cu 63)	Zu 65	? 68	Es 72	As 75	Se 78	Br 80	
" 4	Rb 85	Sr 87	(Yt 88)	Zr 90	Nb 94	Mo 96	? 100	Rn 104, Rh 104, Pl 106, Ag 108.
" 5	(Ag 108)	Cd 112	In 113	Sn 118	Sb 122	Te 125	I 127	
" 6	Cs 133	Ba 137?	(Di 138)	Ce 140	.....	.....	.....	
" 7	.....	.....	.....	.....	.....	.....	.....	
" 8	.....	.....	Er 178	La 180	Ta 182	W 184	? 190	Os 195, Ir 197, Pt 198, Au 199.
" 9	(Au 199)	Hg 200	Tl 204	Pb 207	Bi 208	.....	.....	
" 10	.....	.....	.....	Th 231	.....	Ur 240	.....	
Highest oxide.....	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4
Highest hydrogen compound.....	.....	.....	RH_3?	RH_4	RH_3	RH_2	RH	

Lead Desilverizing by the Zinc Process.

Some few years since the system of desilverizing lead with zinc, invented by Mr. Flach and tested at the smelting works of Messrs. Guillem at Marseilles, was fully described in the *Mining Journal*, and an interesting account is now given by Mr. James E. Stoddart of the manner in which the process is carried on by Mr. William Lang, Jr., and Co., at the Clyde Leadworks, Glasgow. He explains that the treatment of argentiferous lead with zinc, for the purpose of extracting the silver and refining the lead, is by no means a novel process. About 20 years ago a metallurgist named Parkes took out patents for desilverizing rich leads by means of zinc, and a manufacturing firm adopted his process. They were, however, subsequently obliged to abandon it, in consequence of the difficulty experienced in the separation of the zinc from the concentrated silver, to admit of the cupellation of the latter metal. A German chemist, named Flach, afterwards took up the subject, and by running the alloy of zinc, silver, and lead, along with iron slag, through a peculiarly constructed blast furnace, was enabled to free the concentrated silver-lead from zinc. He also proposed the use of this furnace for the removing of traces of zinc from the desilverized lead, but this was abandoned in favor of the ordinary improving or calcining pan. The operation with the blast furnace was found to be very troublesome, and, as the greater portion of the zinc was entirely lost, was by no means economical.

M. Manes, of Messrs. Guillem & Co., Marseilles, who were the first to work Flach's process, found out and patented a simple means of treating the alloy and recovering the zinc by distillation. This is the process now in use, and known as the Flach-Guillem process, and which is carried on at the Clyde Leadworks in the following manner: About 18 tons of rich lead, containing generally from 60 to 70 ozs. of silver per ton, are melted in a large cast iron pot, 1 per cent by weight of zinc is added, and the whole well stirred for 20 minutes. The fires are drawn, and the contents allowed to settle and cool until the zinc rises to the surface, and forms a solid ring or crust, containing the silver and other foreign metals. This alloy is removed to a small pot at hand, where part of the lead is sweated out, and the alloy thoroughly dried. The large pot, with the lead now partially desilverized, is again heated up and treated in the same way as before, but with the addition of only ½ per cent of zinc, which when it has risen to the top is removed as before and dried. A third addition of ¼ per cent of zinc is found necessary to take out the remainder of the silver, care being taken on the cooling of this zincing that all the crystals are cleanly skimmed off. The lead in the large pot is assayed, and found almost always to contain less than 5 dwts. of silver to the ton of lead; if it should happen to contain more, it is due to carelessness on the part of the workmen. The pot is now tapped, and the lead run down into an improving pan, where it is kept at a high heat for nearly eight hours, for the purpose of oxidizing or burning off the small percentage of zinc which is left in it from the zincing process; after seven or eight hours' firing in this pan, it should contain no trace of zinc. It is then tapped and run into moulds for market lead or for the manufacture of lead products. The old improving pans were made of cast iron, placed on a bed of sand, with a groove in the upper sides, which groove was filled with bone ash, to prevent the action of oxide of lead on the iron. These pans, from the giving way of the bone ash and the great wear and tear on the iron from the high heats necessary, were found to be both troublesome and expensive, being very often under repair, and seldom lasting more than six or eight months. They have been superseded by an improving pan of cast iron, lined with brick inside. This pan, instead of being placed on a bed of sand as was the case with the old improving pan, is hung on brick walls, and is quite open both below and round the outside. This new pan has been working in the patentee's works, Marseilles, for some years, and at the Clyde Leadworks for the last eighteen months, without any breakdown. It burns no more coal, and can be as economically worked in every way as the old pans.

The zinc and silver alloy after being dried is melted in a plumbago crucible, covered on the top, well luted with fireclay, connected with a cast iron receiver by means of a plumbago pipe, and fired up with coke. The zinc distils over, and is condensed in the iron receiver. After all the zinc has been distilled, the pipe is disconnected, the cover removed, and the lead and silver left in the crucible is ladled out into moulds; thence it is taken to the refinery, where it is cupelled in the usual way. The block of metallic zinc recovered in the condenser is removed, and used over again in the first part of the process. All the oxide of lead and dross formed in the different processes are taken to the reducing furnace, mixed with the coal dross, and reduced back to the metallic state. The dross from this furnace still contains some lead, and is put through the slag hearth—a blast furnace fired with coke—the fumes of lead oxide from which are condensed in what is known as Johnson's patent condenser, and are all recovered. The lead from the slag hearth, which contains a number of impurities, as copper, antimony, iron, or sulphur, is taken to the improving furnace—a furnace built in exactly the same way as the dezincifying pan. About 20 tons of this lead are heated for a period generally from four to five days, but the time varies according to the amount of impurities present. The oxidized impurities as they are formed float to the surface, and are skimmed off by the workman, who is made to keep the lead perfectly clean, so as to have a fresh surface always exposed to the action of the flame. The dross skimmed off is at first of a black color, but gradually becomes lighter as the operation goes on, until it shows nothing but yellow oxide of lead. When this appearance is noted the pan is tapped into moulds or into the desilverizing pot, where it is treated with zinc, and the silver extracted as in the manner before described.

By this process the lead can be desilverized and turned out in the shape of market lead in 30 hours from the time it is put in process, the loss in working being not more than 1¼ per cent. That all the silver is thoroughly taken out may be seen from the fact that there is an excess of silver, to the extent of nearly 2 per cent, over the assays obtained on the large scale. An analysis of the market lead gave antimony 0·0015 and silver 0·0004 per cent, a trace of copper, but no iron or zinc, from which it will be seen that the lead refined by the zinc process is almost chemically pure, and to this is due the finer quality of the products manufactured from it.

An English View of American Manufactures.

It is incumbent upon the manufacturers of the United Kingdom to show the world at Paris next year that they have not fallen behind the position they once occupied. The competition at Philadelphia was not altogether satisfactory to us.

It is true that every nation has an advantage in exhibitions held within its own area; but the products of the industry of the United States surpassed our own oftener than can be explained by this circumstance. It appeared as if there was a greater economy of labor habitually practised in the States, and in conjunction with this there was evidence of the more constant presence of a presiding mind superintending every process of industry. The best machine in the world will fail to give satisfaction if there is not an intelligent human being at hand to watch it, to take care of it, to detect the smallest failure in its working as soon as it is developed, and to suggest and supply the means of correcting any miscarriage of its functions.

A steam engine dropped from heaven in the middle of Africa might be adored, but could not be put to any use. The failure of many of our industrial enterprises in foreign parts can be traced to the difficulty in procuring agents and assistants that can be taught to use the machines committed to their care.

Much of the mechanical work shown at Philadelphia was executed with a fineness that could not have been exceeded if every man who had any share in its production had originally conceived it and had been solely interested in its success. There was evidence of personal care and personal anxiety; every stage must have been watched with intelligence and with zeal. In comparing the results with our own, we are painfully suspicious that they revealed the application of more brains than we always have at our command.—*London Times.*

Platinum Plating.

M. Dodé has patented a plan for giving cast objects a coating of platinum. The object as cast, or after being enameled, is first washed over with a brush dipped in turpentine; a mixture of borate of lead and oxide of copper is next applied, and the casting dried in a drying stove. The next step is to immerse the object so prepared in a composition of borate of lead, German litharge, platinum in the state of chloride, ordinary ether, essence of lavender, and anilic (?) acid. Finally, the platinized object is submitted to the action of heat.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT DRILLING APPARATUS.—WILLIAM H. CAMMEYER AND SAMUEL LEWIS, APPELLANTS, *vs.* JOHN NEWTON, WASHINGTON ISETTS, CHARLES ECCLESTON, AND WILLIAM L. QUINN.

[Appeal from the Circuit Court of the United States for the Southern District of New York.—Decided October Term, 1876.]

Mr. Justice Clifford delivered the opinion of the Court, which was to the effect that the device used by defendants was not covered by the patent of plaintiff. The Court affirmed the following points:

Inventions may be assigned before they are patented.

Public employment is no defence to the employee for having converted the private property of another to the public use without his consent, and without just compensation.

Private property, the Constitution provides, shall not be taken for public use without just compensation, and it is clear that that provision is as applicable to the Government as to individuals, except in cases of extreme necessity in time of war, and of imminent and impending public danger.

A patent is private property, and the Government cannot, after it is issued, make use of the improvement any more than a private individual without license of the inventor, or making him compensation.

Important Patent Decision in Canada.

In 1873 the Canadian Patent Office granted three patents to George T. Smith, one for a process of milling, and two for flour dressing machines.

The following is an extract from the Patent Act of 1872, as amended in 1875:

SECTION 28.—Every patent granted under this act shall be subject and expressed to be subject to the condition that such patent and all the rights and privileges thereby granted shall cease and determine, and the patent shall be null and void at the end of two years from the date thereof, unless the patentee, or his assignee or assignees, shall, within that period, have commenced, and shall, after such commencement, continuously carry on in Canada the construction or manufacture of the invention or discovery patented, in such manner that any person desiring to use it may obtain it, or cause it to be made for him at a reasonable price, at some manufactory or establishment for making or constructing it in Canada: and that such patent shall be void if, after the expiration of twelve months from the granting thereof, the patentee, or his assignee or assignees, for the whole or part of

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his interest in the patent, imports, or causes to be imported, into Canada, the invention for which the patent is granted; and provided always, that in case disputes should arise as to whether a patent has or has not become null and void under the provisions of this section, such disputes shall be settled by the Minister of Agriculture or his Deputy, whose decision shall be final.

"2. Whenever a patentee has been unable to carry on the construction or manufacture of his invention within the two years hereinbefore mentioned, the Commissioner may, at any time not more than three months before the expiration of that period, grant to the patentee a further delay on his adducing proof to the satisfaction of the Commissioner that he was for reasons beyond his control prevented from complying with the above mentioned condition."—*Patent Act of* 1872, *as amended in* 1875.

We have received from the Minister of Agriculture, of Ottawa, Canada, a book of 24 pages, setting forth the facts, law, and decision in the above case. The case is one in which Benj. Barter (the disputant) alleges the forfeiture of the three patents granted to Geo. T. Smith (the respondent), on the grounds of *non-manufacturing* within two years of the date of each patent, and on the ground of *importing* after twelve months, in terms of the above Sec. of the Acts of 1872 and 1875. The case was deemed of such importance in itself and in its bearing on Canadian patents in general, that it was deemed of public interest by the Minister of Agriculture to report it at some length and in detail.

Messrs. Edgar, Fenton, and Richie, of Toronto, were counsel for Barter; Messrs. Grahame, Howland, and Byerron, of Toronto, counsel for Smith.

Before the Deputy of the Minister of Agriculture.

The petition addressed to the Honorable the Minister of Agriculture (bearing date the 18th of October, 1876) by the disputant, represented that patents No. 2,409, for a process of milling; No. 2,557, for a flour-dressing machine, and No. 2,258, also for a flour-dressing machine, granted to George Thomas Smith in 1873, are null and void, and should be so declared for non-compliance with the provisions of the 28th section of the Patent Act of 1872, requiring manufacturing within two years and forbidding importation after twelve months. The petition asked that the patentee should be required, in case he should state that his inventions have been manufactured, to furnish the particulars. The petition furthermore alleged that importations of the said inventions had taken place on the 25th day and on the 29th day of April, 1876.

The parties appeared at the office of the Minister of Agriculture, at Ottawa, Ont., with their witnesses and documentary evidence. After an exhaustive examination of the case, the Deputy Minister rendered his decision, which is final, in favor of Smith. The Deputy Minister, in giving his decision, reviews at length all the points at issue, carefully digests the Canada patent laws, and cites from patent decisions both in this and foreign countries. We have not space to publish the decision in full, but such extracts only as seem most interesting and instructive to our readers. In the decision, he states: "It is universally admitted in practice, and it is certainly undeniable in principle, that the granting of letters patent to inventors is not the creation of an unjust or undesirable monopoly, nor the concession of a privilege by mere gratuitous favor; but a contract between the State and discoverer. * * Invention being recognized as a property, and a contract having intervened between society and the proprietor for a settlement of rights between them, it follows that unless very serious reasons, deduced from the liberal interpretation of the terms of the contract, have happened, the patentee's rights ought to be held as things which are not to be trifled with, as things sacred in fact, confided to the guardianship and to the honor of the State and of the Courts. As it is the duty of society not to destroy, on insufficient grounds, a contract thus entered upon, so it is the interest of the public to encourage and protect inventors in the enjoyment of rights legitimately and sometimes painfully and dearly acquired. The patentee is not to be looked upon as having interests in direct opposition to the public interest, an enemy of all, in fact: 'The gain made by the inventor when his invention is known will be,' says Agnew, 'proportionate to the amount of benefit which the public derive from the use of it.' 'It is almost self-evident,' says an able American author, 'or at any rate readily susceptible of proof, that the magnificent material prosperity of the United States of America is directly traceable to wise patent laws and their kindly construction by the courts.' 'The increasing development,' says Armengaux, 'which inventive genius undergoes, is principally due to the protection, very insufficient as yet, which is granted by most governments to those who are the real promoters of arts and industry.' * * Therefore the real meaning of the law is that the patentee must be ready either to furnish the article himself or to license the right of using, on reasonable terms, to *any person desiring to use it.* But again that desire on the part of such a person is not intended by the law to mean a mere operation or motion of the mind, or of the tongue; but in effect a *bona fide* serious and substantial proposal, the offer of a fair bargain accompanied with payment. As long as the patentee has been in a position to hear and acquiesce to such demand, and has not refused such a fair bargain proposed to him, he has not forfeited his rights. * * Therefore, George Thomas Smith's patents, No. 2,257, for a flour-dressing machine; No. 2,258, for a flour-dressing machine, and No. 2,409, for a process of milling, have not become null and void under the provisions of Section 28th of the Patent Act of 1872."

J. C TACHE,
Deputy of the Minister of Agriculture.

DEPARTMENT OF AGRICULTURE,
PATENT OFFICE,
OTTAWA, 15th February, 1877.

NEW BOOKS AND PUBLICATIONS.

NATURAL PHILOSOPHY FOR BEGINNERS. With Numerous Examples. Part I: The Properties of Solid and Fluid Bodies. By I. Todhunter, M.A., F.R.S., St. John's College, Cambridge, England. Price $1.50. London and New York: Macmillan & Co.

Mr. Todhunter's renown as a teacher is well known in this country, where his numerous works on mathematics and mechanics are highly valued and extensively used. His latest work is the above-mentioned, and it is an admirable textbook, prepared and edited with the greatest care and accuracy. The writer evidently possesses in an unusual degree the skill to impart knowledge in clear and unmistakable language, and he presents the phenomena and the laws and applications governing them in a manner specially adapted to the capacities of young students. We commend this book to the notice of boards of education, in the belief that the time is coming when elementary science and scientific methods of thought will form part of the common school education of this country.

THE CHEMIST'S MANUAL. A Practical Treatise on Chemistry. By Henry A. Mott, Jr., E.M., Ph.D. Price $6. New York city: D. Van Nostrand, 23 Murray street.

This is one of those books for which professional men generally keep a sharp watch, and which, when purchased, they do not lock up in a case, but place within easy reach of the hand on the working desk. Why they do this is because they have learned or may learn that the author, for some seven years past, has pursued that invaluable habit, the taking of notes. Beginning while a pupil of some of our most eminent chemists, he listened attentively and jotted down useful hints and suggestions, important references, etc., which he has now utilized for his own benefit. Continuing the habit in the practice of his profession, the memoranda soon assumed large proportions; those who knew of their existence, knew also their value; their publication, if only for their preservation in permanent form, was suggested, and hence the large and handsomely executed book before us. The work is by no means a mere compilation, but bears the marks of close and assiduous labor. Every scheme of analysis, for instance, has been proved to be thoroughly right; and as every formula for every reaction is given, this part of the book is of especial value to the student. Another very important portion of the volume, to druggists and physicians, is an elaborate table wherein all drugs in use are named, and their usual impurities denoted, and how the same may be detected. Dr. Mott deals *in extenso* with qualitative, quantitative, and blowpipe analyses, assaying, mineralogy, stoichiometry, and specific gravity determinations, and adds a miscellaneous department, replete with the species of information which, though constantly needed, is scarcely ever found collated. The author's style of writing throughout is plain and direct, the explanations are lucid, and altogether the work is one we can cordially commend.

DYNAMICS OR THEORETICAL MECHANICS. By J. T. Bottomley, M.A., etc. New York city: G. P. Putnam & Co., 182 Fifth avenue.

This is another volume of Putnam's "Elementary Science Series." It is a good simple treatise, as a rule clearly written; but it reveals obscurity in the writer's mind as to the proper definition of the term "force." This is the grand stumbling block for writers on mechanical subjects, and it is high time that a definite meaning should be attached to so fundamental a conception.

AN ANALYSIS OF RELIGIOUS BELIEF. By Viscount Amberley. New York city: D. M. Bennett.

We would take this opportunity to inform publishers and correspondents that the columns of this journal are not open to the discussion, review, or criticism of matters pertaining to religious faith; and that it is entirely useless to send us letters or books on such subjects. The volume above named is the work of a young English nobleman, now deceased. It created great comment in England at the time of its publication, and caused much pain to the friends and relatives of its author, who, being best conversant with the circumstances of its production, made every effort to prevent its circulation. The present publisher, as a matter of charity and good taste, should have respected these desires. Hereafter, books of this class sent to us will remain unnoticed.

A TEXT BOOK OF MINERALOGY. By Edward S. Dana. Price $5. New York city: John Wilcy & Sons, 15 Astor place.

This work originated with Professor J. D. Dana, who undertook its preparation several years ago, but was compelled to relinquish the task because of ill health. The present editor has now carried out the plan, and has produced a very excellent book. It is brought fully up to the latest discoveries and investigations; the modern system of chemical formulæ is used throughout; and the general arrangement of the volume could hardly be improved. The work is especially valuable as a book of reference for the library, as its various subjects are concisely yet fully treated, while they are rendered conveniently accessible through a copious and valuable index. For schools and colleges, probably no better text book relating to this important subject could be found than this.

ROSE CULTURE.—The Dinger and Conard Company, of West Grove, Chester county, Pa., the great rose vine culturists, have just issued their annual catalogue for 1877. The pamphlet is illustrated, giving names and cuts of new varieties, with instructions as to soil and how to grow and propagate roses in the best manner. We have purchased of Messrs. Dinger & Conard's Company a variety of plants at different times, with invariable satisfaction as to the result. To persons interested in roses, we would recommend the inclosure of 10 cents to the above firm for a copy (by mail) of their new manual.

DREAMS OF A FREE TRADE PARADISE.—This is a gathering of humorous sketches and dialogue, with 12 illustrations on free trade. A very amusing pamphlet. Price 30 cents. Henry C. Baird & Co., Philadelphia, Pa.

Inventions Patented in England by Americans.

From February 20 to March 8, 1877, inclusive.

ALLOY.—F. Raymond, Greenville, S. C.
BALE TIE.—J. H. Elsworth, Galveston, Texas.
BATH, ETC.—C. A. Blessing, Philadelphia, Pa.
BOOT SOLE.—S. J. Gordon, New York city.
BRAKE AND RUDDER.—J. Hutton, New York city.
BREECH-LOADING GUN.—F. L. Bailey (of Indianapolis, Ind.), London, Eng.
CAMPAIGNE BISCUIT.—C. Morfit (of Baltimore, Md.), London, Eng.
CLEANSING WOOL, ETC.—O. Low, Chelsea, Mass.
CRUTCH FERRULE, ETC.—T. C. Allen, New York city.
DISPLAY CARD, ETC.—H. H. Snow, New Haven, Conn.
HARROW, ETC.—G. W. Martin, Port Hudson, La.
HORSE COLLAR.—E. Payne, Chicago, Ill.
KNIFE-CLEANING MACHINE.—L. Guex, Springfield, Ill.
KNITTING MACHINERY, ETC.—C. H. Landenberger, Philadelphia, Pa.
LIGHTING GAS.—C. K. Trull, New York city.
LOCOMOTIVE ENGINE.—H. C. Wells, Brooklyn, N. Y.
PRESERVING MEAT, ETC.—J. P. McLean, New York city.
SCREW MACHINERY.—J. A. Kernochan, Pittsfield, Mass.
SKATE FASTENING.—E. H. Barney, Springfield, Mass.
SPINNING MACHINERY.—E. Harris, Providence, R. I.
TAG, ETC.—T. P. Marston, New York city.
WASH STAND.—H. A. Richardson, New York city.

Recent American and Foreign Patents.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED CARD RACK.

Francis Hayek, New York city.—In this card rack any desired number of cards may be arranged in alphabetical and regular manner, so as to be instantly found, the rack being of compact shape and admitting the arrangement of twice the number of cards on the same space as the card racks in common use. The card rack has a number of pivoted clamp pieces that are connected to a slide rod, to be thrown to one side or the other for putting in or taking off cards from the clamps. The cards whose names begin with one letter form the face, those with the next letter of the alphabet the back, on each clamp piece, the cards of either letter being readily exposed by throwing the clamping pieces by the slide piece to one side or the other.

IMPROVED IMPLEMENT FOR LOADING FIREARMS.

Charles W. Hovis, Parker City, Pa., assignor to himself and W. J. Hovis, of same place.—This invention is a revolving case containing chambers suitable for holding a charge in each one for the gun to be loaded, working between two plates which close the chambers at the ends, except at one place, where there is a chamber to receive the muzzle of the gun to be loaded, and hole through each plate coinciding with it, so that the load can be pushed out of the loader into the gun when the muzzle of the latter is in said chamber, and under each chamber is a valve to retain the load till ready for discharge.

IMPROVED BALE TIE.

James M. Polland, New Orleans, La.—This invention is an improvement upon the so-called "B" tie, for which letters patent were granted to same party on November 28, 1876. In the present invention, the lug or projection, which in the former invention engages the slotted band, is dispensed with, also the slots in the free end of the band, and a roller or movable cam is employed for engaging the band and effecting the "lock."

IMPROVED FLUID MEAT.

John L. Johnston, Sherbrooke, P. Q., Canada.—This is a compound consisting of lean flesh and albumen, in the form of a dry powder, and the well known gelatined meat essence.

IMPROVED TYPE MOULD.

Thomas Mason, New York city, assignor o David Wolfe Bruce, of same place.—This is a type mould provided with one or more oppositely disposed angular projections or shoulders within its breaks for severing the jet from the type. Its object is to dispense with that process of type-founding known as "breaking off."

IMPROVED NECK YOKE RING.

Charles Shuman, Red Oak, Iowa.—This ring is so constructed as to allow the neck yoke to be turned nearly parallel with the tongue.

IMPROVED LASTING JACK.

Charles H. Collins, Lynn, Mass., assignor to himself and Francis Deshon, of same place.—The advantages claimed for this invention are that a whole boot or shoe can be lasted complete without the aid of knees or other devices for pulling the upper over. The toe of the boot or shoe may be thrown over, bringing it into a convenient position to last the toe, after which the jack can be readily readjusted to a vertical position. It can be conveniently used at a high or low bench, and the operator may stand or sit at pleasure.

IMPROVED TRAVELER FOR JIB-SHEETS.

Joseph D. Drinker, Montrose, Pa.—This is an improved bar for holding the jib-sheet in a fore and aft vessel, when beating to windward, so as to dispense with a man to attend to said jib. It shifts over the sheet automatically on going about.

IMPROVED CURRYCOMB.

James N. Rundle, San Francisco, Cal., assignor to himself and David L. Fonseca, of same place.—This currycomb is so constructed that it wil clean itself of dust and hair while being used, rendering it unnecessary to knock it against the timbers of the stall or stable. The frame and the tooth plates play upon a hinge. The movement is limited by a keeper, so that the jar caused by checking the said movement may knock off any dust and hair that may be adhering to the tooth plates.

IMPROVED FOLDING SEAT.

Arthur B. Cogswell, Burlington, Vt.—This seat is so constructed that it may be folded so compactly that it will occupy no more space than the breadth of the side frames or standards. When the seat is extended for use, the rear edge is raised and drawn forward, bringing the pins into the long arm of the slot in the standard. The seat then drops, by its own weight, into position.

IMPROVED INDICATOR.

Charles C. Curtiss and James Curtis, Chicago, Ill.—This is an improved dial, on which a business man, upon leaving his office, may indicate with great facility whether he is in or out, or that he is out and back at a certain time. It consists of a base dial, with the hours and the words "In," "Out," "Back at" marked thereon, on which, within the outer circumference, a second partly recessed plate or disk is guided, and above the same one or two index hands for indicating the time, the recessed plate and hands being returned by a face plate or disk.

IMPROVED VAPOR BURNER.

Frederick A Sawyer, Houston, Tex., assignor to himself, Addison H. Baldwin, and Artemas N. Carter, of same place.—This is an improved construction of a vapor burner, by which the same may be readily lighted or adjusted to a larger or smaller flame. An outer sleeve or jacket with disk-shaped flange slides below the outer burner tube for protecting the burner against a draft of cold air from below.

IMPROVED BAGGAGE CHECK GUARD.

David Untermeyer, New York city.—With this device no one, not even the baggage-master, can see the check or know what it is after the duplicate check and the key have been delivered to the passenger, until such passenger presents his check and key. In the outer side of a door is formed a slide to receive a ticket, upon which is marked the place to which, and the place from which, the baggage is sent. With this device it would be useless for a thief to change the direction ticket, and thus change the destination of the trunk, as even then he could not get the trunk without the check and key, which the owner of the trunk carries.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF VENTILATING ROOMS.

Gregory C. Quezada, Troy, N. Y.—The object of this invention is to provide fresh air continually for theaters, churches, rooms, etc., and also at the same time to lower the temperature of the same and supply a certain degree of moisture. The invention consists of an outer pipe column or tubular body of suitable non-porous material and of an inner pipe of porous material, between which a space is formed that is filled with water or other liquid. The air is drawn through or forced through the tube by a fan or otherwise, and supplied to the room at reduced temperature. The apparatus is based on the principle of lowering the temperature by the evaporation of water or other liquid percolating through a porous pipe. The air in its passage through the porous pipe is thus cooled and furnished to the rooms.

IMPROVED SASH BALANCE.

Jules Houriet, Terre Haute, Ind.—This invention consists of the combination, with the upper and lower sashes, of a cord that is connected to the upper sash, clamped to the lower sash, and passed over a pulley at the top of the window casing. For raising the lower sash the upper cord is taken hold of and pulled till the sash arrives at the required height, where it is fastened by a suitable sash lock, it being lowered again by its own weight on the release of the lock.

IMPROVED BOX-NAILING MACHINE.

Amos P. Goodhue, Fond Du Lac, Wis.—This is an improved machine for nailing together the parts of round boxes, enabling the boxes to be nailed quickly and accurately. In using the machine, the bottom of the box is placed upon the center of a plate, and the hoop of the box is placed upon the flanges around the edge of the said bottom. A crank is then turned to bring all the slide blocks inward to rest against the hoop of the box, and press it against the edge of the said bottom. A shaft is then turned until punch holders have reached the limit of their forward movement, and the punches are then adjusted so that their forward ends may strike the hoop of the box. The punches are then drawn back, nails are inserted into the dies, the die holders are turned down into a horizontal position, and the punch-driving mechanism is thrown into gear, which carries the punches forward and forces the nails into the box. As the punches are withdrawn their driving mechanism is thrown out of gear, and the die holders rise into a vertical position, so that another set of nails can be readily placed in their dies.

IMPROVED METHOD OF OPERATING SAWMILL CARRIAGES.

Martin Lally, Eau Claire, Wis.—The wheel on the driving shaft, being rotated, causes a chain to draw the carriage in one direction or the other with a positive motion. The tightening pulleys take up the slack in the chain, so that the carriage answers to every motion of the driving wheel.

NEW TEXTILE INVENTION.

IMPROVED SPOOLER.

Samuel F. Cobb, Alberton, Md.—This invention relates particularly to the form or construction of a slotted cam cylinder and the combination of the same with traversing bars carrying the thread guides and working horizontally in slots formed in the sides of the arches, or frames, in which the spool spindles are journaled. The machine can be so changed as to increase or decrease the traverse simply by removing the gear, thereby enabling the operator to make as even and regular layers when spooling number four yarn as when spooling number fifteen, presenting all the while the spool is being filled a smooth even surface to the thread, consequently the spool must be finished as commenced. In other spooling machines, the traverse is generally worked without this provision, and changing them from fine to coarse numbers produces an uneven ridgy surface, which grows worse as the spool increases in size.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SULKY ATTACHMENT FOR PLOWS.

Samuel P. Langsford and Wiley N. Stroud, Waxahachie, Tex.—By this invention a farmer is enabled to apply any kind of plow to the sulky frame, and thereby do all his work with the same without having to walk in plowing. The invention consists of a sulky frame, to which the plow beam is rigidly applied, the connecting pieces and tongue being capable of adjustment to the position of the plow beam on a vertically sliding crosspiece, which is raised or lowered, so as to elevate or depress the plow, by lever connection with the seat of the sulky.

IMPROVED RECIPROCATING CHURN.

Bernhard Janson, Effingham, Ill.—This invention consists in a churn body having a handle and cover attached thereto, and provided with a socket on its lower side, which is adapted to receive a stud or pin on a stationary base piece or platform. The churn barrel turns on a fixed axis, and receives a rocking or tilting movement to the right and left, by making the recess in the projection of the churn larger than the axis pin.

IMPROVED HARVESTER.

Andrew Campbell, Nebraska City, Neb.—This invention consists in two special combinations—one for the fingers and bars, the latter with sharp edged front tooth, and another combination of the reciprocating heads, having depending teeth, cutters, and cutter guards, with endless apron carrying the grain directly back therefrom.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Grasshopper Killer for sale.—State and County rights of Patent No. 187,855, Machine to kill Locust. Apply to Charles Hoos, Arago, Nebraska.

Silver Solder and small Tubing. John Holland, Cincinnati, O.

For Sale.—Recently granted Patent on Toy Birds. Rapidly vibrating wings, accompanied by a suitable sound. Manufactured very cheaply from sheet metal or printed paper. Address S. Scholfield, Providence, R. I.

Situation wanted by a man who understands to plate hardware with bronze or brass, nickel on zinc, etc., etc. Address Box 330, Ansonia, Conn.

Financial Partner wanted in Inventions illustrated on first page; also parties to solicit contracts. Address J. J. Harden, 83 West Van Buren St., Chicago, Ill.

Foot Lathes. W. E. Lewis, Cleveland, O.

The *Western Manufacturer*, of a recent date, says: "Rock Falls, Ill., is the largest manufacturing town of its age in the West."

Every possible advantage given to Manufacturers on the Water Power at Rock Falls, Ill., by A. P. Smith.

Brown's Patent Chandeliers and Bracket Lights, the only non-explosive lamp in existence, and warranted. Rights or lamps for sale. Send for circular to Wm. Brown, 16 Bromfield St., Newburyport, Mass.

Wanted.—Light Second-hand Rails for a 3½ miles' road. Address A. Moresi, Jeanerette, La.

A Havana merchant will accept the agency of first-class articles. Address Merchant, 15 Calle Tejadillo, Havana, Cuba.

Common Sense Chairs and Rockers. Solid comfort all around the house. Send stamp for illustrated price list to F. A. Sinclair, Mottville, N. Y. For sale by the trade.

For Sale.—A valuable Patent. For further information, address Kelly & Ludwig, Philadelphia, Pa.

Patent Double Eccentric Cornice Brake, manuf'd by Robinson & Co., successors to Thomas & Robinson, Cincinnati, O. Send for circulars.

Safety Linen Hose for Stores, Factories, Hotels and Steamboats, at best rates. Greene, Tweed & Co., 18 Park Place, N. Y.

Painters.—Send for new prices of Metallic Graining Tools, for "wiping out." J. J. Callow, Cleveland, O.

For the best Galvanized Iron Cornice Machinery for all kinds of work, apply to sole owners, Calvin Carr & Co., Cleveland, O.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand st., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Catechism of the Locomotive. 600 pages, 250 engravings. $2.50. Address M. N. Forney, 73 Broadway, N. Y.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Arny, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Cotton Belting, light and heavy, for Polishing and Carrying Belts. Greene, Tweed & Co., 18 Park Place, N. Y.

For Solid Wrought iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Notes & Queries

A. V. E. will find directions for mending rubber boots on p. 203, vol. 30.—M. F. will find directions for making a Daniell battery on p. 326, vol. 32.—J. H. V. H. will find a description of the process of photo-lithography on p. 272, vol. 32.—S. can remove marks tattooed on the skin with Indian ink by following the instructions on p. 331, vol. 30.—W. A. H. will find something on the results of the transit of Venus observations on p. 180, vol. 32.—E. will find a recipe for bay rum on p. 363, vol. 29.—J. S. D. will find directions for making paste for marking with stencil plates on p. 379, vol. 35.—J. E. L. will find a recipe for a depilatory on p. 186, vol. 34.—J. R. will find a recipe for aquarium cement on p. 202, vol. 28.—E. G. P. will find an article on multiple telegraphy on p. 197, vol. 29.—C. H. H. will find on p. 187, vol. 32, directions for making battery carbons.—G. H. will find something on polishing woods on p. 315, vol. 30. For French polish, see p. 11, vol. 32.—J. H. B. will find on p. 21, vol. 36, directions for lining kettles with porcelain.—F. P. R. will find an explanation of the term "nominal horse power" on p. 33, vol. 33.—W. F. A. will find directions for bending timber of all kinds on p. 26, vol. 31.—A. M. P., B. N. R., S. W., F. C., J. B. M., W. H., C. P. G., R. F. W., N. K., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. G. says: A is a movable wheel, moving around and gearing into a wheel of the same size. How many times will A turn on its axis in going once round B? A. Twice, under the conditions stated.

(2) D. M. says: 1. I use an upright 3 horse power engine to run my presses. The boiler is cast iron with about 10 small flues up through it. Is this dangerous? A. Your description is rather indefinite, and though we think that in general the use of cast iron in boiler construction is objectionable, we do not know that your boiler is especially dangerous. 2. I use rain water from a flat tin roof, painted. Stove coal is used in the building, and the soot settling on the roof causes the water to be dark colored. I have been told that the creosote in the soot will corrode or eat into the boiler and flues where it settles on the top of the water. Is this so? Will the paint on the roof injure the water? A. In regard to the water you use, we scarcely think that its action will be injurious to the boiler. This question can, however, in the absence of an analysis, be settled only by observation, and we advise you to inspect the boiler and connections carefully, at short intervals.

(3) R. E. asks: Can you give me a plain rule by which I can ascertain the horse power of 44 inches diameter by 10 feet stroke engine, and the percentage or useful effect of the engine in horse power spent in working a 20 inches diameter plunger pump, pumping water out of a perpendicular shaft through an 18 inches diameter by 288 inches discharge pipe? The receiving pipe is 20 inches diameter by 10 feet long, capacity of engine is 5 strokes per minute with a boiler pressure of 75 lbs. per square inch. We have in use eight 32 inches x 36 feet cylinder boilers. Distance of engine from boilers is 20 feet. A. The only method by which these facts could be determined with any degree of accuracy would be by experiment. From the data sent, we could not give you a reliable rule.

(4) C. H. R. says: I am anxious to get something that will blow a church organ. We could not use hydraulic motor. Has anything else been invented for the purpose? A. There are hot air, gas, and petroleum engines in the market, some one of which might answer your purpose.

(5) J. C. asks: 1. What degree of heat will steam indicate under a pressure of 100 lbs. to the square inch? A. About 338° Fah. 2. How much can the heat be increased by superheating? A. You can increase the temperature as much as desired by using proper apparatus.

(6) H. V. asks: I am building a boat 50 feet long over all, and of 13 feet beam. I am having two engines built of 7 inches diameter and 8 inches stroke. The boat is to draw 3 feet of water, and to be of good model. I intend to put in twin propellers, one engine on each shaft. What diameter of propeller shall I use, and what speed can I expect from the above dimensions? A. Put in propellers of as large diameter as you can conveniently use. By using counterbalanced cranks or disk wheels, you can obviate all danger of catching on the center. With a good steaming boiler, you may expect to realize a speed of at least 7 or 8 miles an hour.

(7) A. C. asks: Does area of a cylinder mean the open surface? A. You probably refer to the volume of a cylinder, which is the space inclosed by it. It is improper to speak of the area of a cylinder. You can, however, speak of the area of the base and of the convex surface.

(8) F. A. L. asks: How much power do I require to raise water 60 feet through a 1¼ inch pipe to my cistern in attic? A. It depends upon how fast you want to raise the water. It will be easy to raise it by means of a pump that a child can work, or you may use all the power that can be exerted by a horse.

(9) J. K. N. says: Can you explain the cause of the trouble with our cistern? It was built about 18 months ago, is under the house, and holds about 1,200 barrels. This winter it has proved to be leaky; and upon examination, we found that the cement in places, upon the sides and bottom, had puffed up in blisters of 3 or 4 square feet, and some smaller, leaving a hollow space beneath of from one to two inches. Of course, the cement had cracked and caused the leak. The walls of the cistern stand upon the solid rock; but the bottom does not go to the rock, but is plastered upon sand and gravel mixed, about 4 feet from the rock, with cement about an inch thick. There has been more or less water in it ever since it was built. No one hereabout seems to know the cause of it. A. At certain seasons, the water in the ground is more plentiful than at others, and rises to a higher level; if at such time the water in the cistern is drawn down to a lower level than that of the water in the ground, the latter will have the preponderance of pressure, and the upward movement of cistern bottoms is thereupon a very natural result. The remedy consists in constructing the bottom of the cistern arching—like an inverted dome—cementing the prepared gravel bottom, and then turning a brick arch upon it, laid in cement, to hold it down.

(10) W. H. C. says: 1. I have an engine of 6 inches stroke and 3 inches bore. How large a boiler do I want to make it run a small lathe for turning wood not over 6 inches in diameter? I have a boiler 2 feet long, 15 inches in diameter, and $\frac{1}{16}$ thick. How much steam will it stand with 3 rods running through the center of the boiler? A. The boiler will probably answer, and you can carry 30 lbs. of steam. 2. I have a safety valve ½ inch in diameter, with a lever 4 inches long, 1½ inches from fulcrum to center of valve, and a weight of 1 lb. How much steam can I get before it blows off when my ball is at the full length of the lever? A. The data in regard to your safety valve are not sufficient for a complete calculation; but when the ball is at the end of the lever, the pressure required to raise the valve will be between 40 and 50 lbs. per square inch.

(11) D. F. H. asks: Could not a steam boiler, that would be safe, be made by placing the heads on each end of shell and passing the tubes through the heads, to be fastened by nuts on the ends? A. Such boilers are frequently used on steam vessels. All the tubes are not secured by nuts, but several are made heavier than the others, and are fastened in this way.

(12) S. A. S. says: Can you give me a recipe for making a bright crimson dye, for the purpose of dyeing ordinary white muslin? A. Mordant the cloth with tin salt, and dye in a hot bath of madder extract or alizarine. There are numerous works on the art of dyeing, etc. See our advertising columns for names and addresses of publishers.

(13) T. C. P. says: I use 1 inch gas pipe for a heater and supply. I want to know if a 2 inch pipe in its place would be harder on the pump, as the pump has a 1½ inch plunger, and is run by eccentrics at 200 revolutions per minute. My object is to heat the water hotter. A. It will not.

(14) N. H. T. says: 1. I have a horizontal boiler 3 feet long and 20 inches diameter, with firebox 20 x 20 inches. The heat and smoke go to the front into a smoke box and come back through about 35 one inch tubes to the chimney. It has been tested to 150 lbs. per square inch. Is it large enough for a vertical launch engine 3½ x 5 inches? A. The boiler will probably answer very well. 2. How fast will this engine and boiler run a boat 25 feet long, built for the purpose? A. You may expect a speed of from 5 to 6 miles an hour in smooth water. 3. Can I get as much power with the same engine and boiler condensing in a vacuum, as I can using live steam? A. Yes, and more, other things being equal.

(15) J. Y. P. says: Please give me your opinion of the amount of power required in a machine for pulling pine stumps, and the kind and size of chain necessary, when used double? A. Without knowing what kind of a machine you have in view, we are unable to give you any information. So far as we know, a little giant powder, or some similar compound, forms the most efficient stump extractor that has yet been introduced.

(16) T. V. D. asks: How can I build a cistern? A. One of the first considerations is the nature of the soil in which the cistern is to be built. In some hard soils, an excavation is sometimes made carefully to the size required, the bank sprinkled with water, and then a coat of cement applied to it, without building a wall. In most cases, however, it is best to construct a cistern with brick walls, bottom and top. Let the form be cylindrical, the top arched in the form of a dome, and the bottom in the form of an inverted dome. If economy is an object, the walls may be 4 inches thick for 8 feet diameter or less—larger than this will require 8 inch walls—and all laid in cement. Plaster the interior throughout, together with the top of the crown, with a good coat of cement. Let the crown be 18 inches below the surface of the ground, and place a flat stone on the bottom, directly under the opening in the top.

(17) Y. A. asks: 1. What material or composition, other than lampblack, is successfully employed in the coloring of black mortar joints of brick face work? A. Coal dust and English drop black. 2. What should be the proportion of sand and lime in such mortar, and how should I mix the same? A. Prepare your pointing mortar first, and add color to suit, until the gray becomes black. 3. There is a material known as point black. Is it durable in color? A. We presume you refer to the drop black above referred to. It is the best in use for the purpose, and costs about $2 to the thousand of front brick. We cannot say if it is much in use.

(18) M. W. D. says: 1. I have a recipe for tempering millpicks, by rubbing cyanide of potassa over the steel, heating to cherry red, and dipping in water. After a little experimenting, I was able to produce an excellent temper. But another time I failed. I used great caution not to overheat them; but out of several dozen I had not one that would not crumble like cast iron, and looked as if it were burnt. A. If the grain of your steel, after hardening, appeared coarse or granulated, it must have been overheated. 2. What will be best to temper them in that will not destroy the steel? A. Try heating them in molten lead, and using the cyanide of potassa as before.

(19) J. W. says: Your answer to G. E. C.'s question as to reversing a stationary engine is not correct. If the eccentric of an engine is turned halfway round, to reverse, the valve will be set wrong to twice the amount of the lap of the valve when the valve has no lead, and twice the lead in addition when it has. The position of the valve when the engine is on the center will be wrong by 1½ inches in an engine cutting off at ¾ stroke, with a 3 inch travel to the valve and no lead, when set by turning the eccentric halfway round. A. Our correspondent G. E. C. spoke of a valve without lap.

(20) T. W. says: We have a belt for polishing spokes, etc., which does not give satisfaction. Can you tell us how to construct a good belt? A. Use sand or quartz glued to a leather belt. Spread the sand on a board, make the glue well hot, coat the belt with glue, lay it glue side downwards on the sand and roll a heavy pulley on the back of the belt to press it into the sand.

(21) H. A. W. asks: 1. How fast should a lathe run while turning a piece of 1 inch bar iron? A. With a good tool, about 130 revolutions per minute. 2. How fast should it run to turn a piece of oak wood 2 inches in diameter? A. As fast as possible.

(22) S. N. says: I wish to heat small article of steel in a lead bath, for the purpose of hardening them by plunging in water after heating, but I find a difficulty from oxidation that takes place on the surface of the lead. What is the remedy? A. Cover the lead with powdered charcoal.

(23) T. S. R. says: 1. I am making a lathe to run by foot or hand power. What ought to be the size of the band wheel to go by hand, and what the size of the band wheel to go by treadle? A. To go by hand, 24 inches diameter. To go by foot, 30 inches. 2. What should be the diameter of the pulley? A. Six inches. 3. Shall I use a leather or rope band? A. Use a leather belt.

(24) J. P. L. asks: Is there any die in use for cutting screw threads on bolts, etc., so constructed that it may be opened at the end of the cut, and be run back without reversing the lathe or die holder? A. Die holders such as you require are made by nearly all the prominent bolt-cutting machine makers.

(25) T. H. B. asks: Why do cast iron kettles for melting metal crack on the bottom about two hours after the fire is started, or as soon as the metal is thoroughly melted? A. Because the bottoms are too thick. Try kettles with thinner bottoms.

(26) E. S. asks: What is the best way to solder wire cloth to a round iron hoop? Is there not a preparation that will cause the solder to adhere readily, and prevent rust? A. Use killed muriatic acid (muriate of zinc); then add 2 parts of water and a little sal ammoniac, determining the quantity by experiment.

(27) T. B. asks: What causes the hardening of saws that are gummed out with emery wheels? A. The spaces between the particles of emery fill up with steel (or whatever is being ground on them), creating a smooth in place of a rough surface; and the friction causes heat, heating the outer surface suddenly, and it cools equally suddenly when the emery wheel leaves it, and the outer shell of the steel hardens. To remove it, hack the wheel. This may be done with the corner of a worn-out file. Then go over the saw very lightly, and grind off the extreme outer surface which has been hardened. It is better to keep the emery wheel hacked and cut off only a little at a time, and go around the saw several times in gumming. It will really require no more time than to do it in the usual way of gumming each tooth clear down before commencing the next one. This is an important matter, as hundreds of saws are ruined for want of this knowledge.—J. E. E., of Pa.

(28) W. C. H. asks: How may copper be permanently colored or stained black? The coatings made by varnishes soon wear off, and a process is desired that will render the color durable. A. There is no coating for metals that can conveniently be applied better than that recommended to A. F., on p. 90, vol. 36.

What is the method of silvering glass? A. See p. 35, vol. 35.

(29) S. G. asks: What can I use to color starch brown, for starching brown linens, cambrics, prints, etc.? A. Try a little soluble Bismarck brown.

(30) G. C., of Ballarat, Victoria, Australia, asks: 1. What do the blind manufacturers in America use to prevent the blistering of the paint on inside blinds? A. Paint is apt to blister when mixed with boiled oil. Use raw oil, and let the paint get dry and hard before exposing it to dampness or rain. 2. What are the ingredients used in the manufacture of green paint? A. Paris green is the principal ingredient used in the greens for painting blinds. The color is shaded by adding black. A bronze green is sometimes made by mixing black and chrome yellow.

(31) A. A. B. says: Please inform me of the cause of and remedy for granulated eyelids? A. The trouble is commonly caused by a weak and impure state of the blood. Use sulphur and iron tonics for the blood, and wash the eyes regularly, three times a day, with the following: Pure sulphate of zinc 3 grains, tincture of opium 10 drops, water 2 ozs.

What is the process of making emery wheels? A. They are usually made by kneading crude caoutchouc, softened by heat, with about half its weight of sulphur, and the proper quantity of fine emery, and vulcanizing the material by heat.

Can a person make a patent invention for his own individual use? A. No.

(32) J. J. says: Please give me a recipe for making vulcanite, to set artificial teeth in? A. The right to manufacture this material is secured by patents It is made by kneading caoutchouc with about half its weight of sulphur and a little Indian red. It is vulcanized by heating for 4 hours, under pressure, at a temperature of 310° Fah.

(33) H. G. says: Please give a recipe for making bar soap? There is one offered for sale by peddlers, as follows: Take 5 gallons ley, 5 gallons water, 5 lbs. tallow, 1 lb. potash, 2 lbs. sal soda, ½ lb. rosin, 1 pint salt, 1 pint washing fluid. Let boil half an hour, which is enough for 100 lbs. But I cannot make it work. It does not take up the grease, and it does not harden. A. Dissolve the potash and sal soda in the water (boiling), and add a few ozs. of caustic lime, stir and allow to settle. Pour off the ley thus formed, and boil this for several hours with the tallow and rosin. Then remove from the fire and add the salt (dissolved in hot water). Stir well, and allow to settle. Pour off the supernatant liquid, gather the precipitated flocculent soap on a cloth, and strain off the excess of liquor by pressure. When dry, this should give you about 12 lbs. hard soap.

(34) I. J. asks: 1. How many lbs. of coal will make a bushel of coke? A. On an average 50 lbs. of cannel coal will yield a bushel of coke. 2. How many lbs. of coke are there in a bushel? A. A bushel of coke weighs about 35 lbs.

(35) H. E. N. asks: What will remove the stain of white paint, that has become hard and set on brown silk? A. Try good chloroform and ether, and then a little soap and water.

(36) T. S. says: I wish to make an intense light in one end of a hall from a single gas jet, the body of the hall being lighted with ordinary gas burners. I wish the light to last for two or three hours. How can I increase the intensity of gas? A. There is no source of brilliant illumination which approaches, in point of economy and controllability, the oxyhydrogen or lime light. Try large argand gas burners, provided with tall chimneys and good silvered reflectors.

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(37) R. C. S. says: 1. A spring is situate on a hill several hundred feet high, and nearly a mile from where we wish to use the water. One half of the required length of pipe is 1½ inches, and the rest 1 inch in diameter. In order to get the best head and largest flow of water, how shall the pipe be used? With the largest size near the spring, or *vice versa?* A. The larger pipe should be placed nearest to the spring, as in this case its contents will act as a head to force the water through the smaller pipe, in which, on account of the greater velocity, there will be the greater friction. 2. Does water in a pipe, under pressure, flow with less friction in coming down hill than on a level or in being forced up hill? A. No. The friction depends upon the velocity without regard to the power. If you remove the power of gravity, water may be forced up hill as easily as down. 3. Is the friction greater when water is forced through a pipe than it would be if it were drawn through the same pipe by suction? A. No. It is forced through the pipe in either case. Where suction is employed, the pressure of the atmosphere is simply removed from one end, and allowed to exert its full force at the other.

(38) S. T. asks: What ingredients can be mixed with aniline red to turn it black without injuring its quality? A. Use hydrochloric acid and chlorate of potassa. Aniline black may be made more economically directly from the aniline oil (crude) by means of the above reagents.

(39) M. M. F. asks: Please give me a recipe for annealing steel very soft? A. Heat it a cherry red, and let it cool in lime.

(40) H. C. D. asks: 1. How is a fine varnish finish put on wood, to be perfectly smooth and glossy? A. First rub down the surface of the wood with pumice powder. Then give three good coats of copal varnish (commonly called furniture varnish), allowing each to dry before applying the next. Rub this down perfectly smooth with pumice powder and water, and finally give the work a good flowing coat of strained varnish. 2. How is a white finish put on wood to represent marble, that will not scratch? It is used on coffins. A. The wood is given several good coats of zinc white, and then rubbed down with pumicestone. It is then flowed with a lacquer of gum aniline, and baked at a temperature of about 300° Fah. 3. What can I use to fill the pores of walnut before varnishing? A. Common oil size is sometimes used; but the best material for this purpose in use is a rough varnish composed of rosin, oil, and turpentine. It is known in the trade as scraping varnish. Several coats of it are applied to the wood and then scraped off with an iron or steel scraper and fine sandpaper, leaving the pores of the wood evenly filled.

(41) W. D. M. says: When do fishes sleep? In my aquarium my gold fish and minnows seem always on the alert. A. Such fishes rarely sleep, unless in very cold water.

(42) J. L., of Manchester, England, asks: How are the castings of zinc figures or statues made in France and Germany? The mode of procedure is, I believe, casting the zinc in brass moulds, with the pattern engraved inside the mould; but I cannot arrive at the way in which they cast them hollow, for by the appearance of the metal no sand core is used. A. The moulds are built in pieces, and the sand is faced all over, for both the inside and outside of the statues, leaving no sand or parting marks on the castings.

(43) S. asks: 1. What is the greatest perpendicular height to which water can be lifted by a steam pump? A. From 30 to 32 feet. 2. Which can lift the highest, a piston or a rotary engine? A. If the two forms of pump are equally tight, there will be no difference in favor of either.

(44) A. E. B. says: 1. I wish to construct a foot power jig saw. The saw blade is to be stretched in a frame after the fashion of the gate saw. A. A man can comfortably make about 120 strokes of the treadle with the foot per minute. This will turn your driver 120 times per minute. 2. How large a driving wheel must I have to attain 800 strokes a minute, and of what size should the pulley be? A. The driver pulley may be from 1½ to 2 inches in diameter, and you can make your own calculation for driver. 3. How large shall I make my flywheel, and will it make any difference whether I have it on the shaft with a pitman pulley or on the same shaft as the drive wheel? A. It is better to attach a pitman to the shaft which carries the driver, because it is more direct and saves the friction of intermediates.—J. E. E., of Pa.

(45) W. H. D. asks: 1. How can I construct a hand pump for the purpose of pumping oxygen gas from a bag into a cylinder, to compress it for a calcium light? A. If you are entirely unacquainted with the details, we think it will be more satisfactory for you to purchase the pump from a maker of philosophical instruments. 2. In making oxygen gas in a cylinder over the fire, how is the pressure gauge made, and what kind of liquid does it contain? A. A pressure gauge can be made of a bent tube containing water. 3. What is a Bunsen burner? A. It is a gas burner in which the gas is mixed with air before being burned. 4. What is the expansive capacity of hot air to the square inch? A. If the volume is constant, the pressure increases about $\frac{1}{493}$ for each 1° Fah.

(46) E. P. B. asks: 1. Will the salt in oil made from butter be injurious to machinery or leather? A. It is better to extract the salt. 2. Is there any cheap way of removing the salt? A. The salt may be extracted from the butter by agitating the same with a large quantity of water just hot enough to fuse it. On allowing the water to stand for a few minutes, the fatty oil will rise to the surface.

(47) J. McT. asks: What is the substance called breeze, mentioned in a recipe for making concrete? A. Small ashes and cinders, sometimes used instead of coal for burning bricks.

Is there danger of a balloon frame rotting when filled in with concrete, the inside of the studs being exposed? A. No, especially if the ends of the studs are not covered with the concrete.

Which is the best to apply to wood, crude petroleum or coal tar? A. Coal tar is best for coating wood underground or where subject to dampness.

(48) R. C. G. says: Our western coal has a great deal of sulphur in it, which makes it very troublesome to work; and as I am a blacksmith, it gives me much trouble. Is there anything that will remedy the evil? A. This cannot be obviated, as the sulphur in the fuel exists in combination with iron as pyrites.

(49) F. S. asks: Is there anything which will take smoke stains from white marble? A. If you do not succeed with soap and water, try rubbing with a little prepared chalk moistened with benzole.

(50) W. B. asks: How can I color brickwork black? A. Use a paint or varnish made from Brunswick black, oil, and turpentine.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

B. B. T.—The material contains nickel, cobalt, arsenic, and sulphides of these metals. After solution, the arsenic may be separated by sesquioxide of iron. Neutralize and precipitate with lime, dry the precipitate, and dissolve it in very dilute oil of vitriol. The iron may then be separated by neutralizing with lime and a little carbonate of lime (chalk). Crystallize the nickel solution, and decompose by roasting.—A. E. F.—No. 3 appears to contain gold, but it would require a quantitative analysis of the ore to determine the amount. We can give no opinion as to the probable value of the ore from the small fragment which you send.—A. E. L.—No. 1 is galena—sulphide of lead. Nos. 2 and 3 consist principally of iron pyrites and marcasite. See p. 7, vol. 36.—C. J. D.—It contains iron, nickel, cobalt, and arsenic.—A box from Mobile city (no letter with it) contains guano of good quality.—O. P.—It contains galena and iron pyrites. See p. 7, vol. 36.—H. C. M.—It is an aggregation of small crystals of smoky quartz. Its occurrence is not necessarily indicative of the close proximity of any valuable metal. See our advertising columns for addresses of dealers in scientific books, who will send you catalogues on application.—A. R. R.—No. 1 is hornblende. No. 2 is galena—sulphide of lead. No. 3 appears to be erubescite—a double sulphide of copper and iron. No. 4 is clay containing a large percentage of carbon. It is not a natural formation. No. 5 is mica schist.—S. M. W.—It is an iron ocher—clay colored with oxide of iron. It is used to some extent, mixed with oil, as a paint for outside work and for floors.—M. S. H.—It appears to contain British gum (dextrin), gum arabic, shellac, borax, soap, glycerin, and some perfume. Shellac may be rendered soluble in water by adding borax.—A specimen contained in small yellow box, with no name on it, appears to be a piece of slag or scoria from some furnace.—C. J. L.—It is a piece of furnace slag.—S. G. McM.—It is sesquioxide of iron.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Bourdon Pressure Gauge. By A. B. W.
On the Attraction of Atoms. By D. P. B.
On Home-Made Philosophical Instruments. By J. P.
On the Telephone. By H. H.

Also inquiries and answers from the following:

L. H.—A. B.—T. A. K.—E. B., Jr.—W. W.—A. J. B.—G. B.—C. A. F.—N. J. W.—J. T. R.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells small distilling apparatus? Where can agricultural steam engines be bought? Who sells electro-magnetic motors? Who sells the best microscopes? Whose is the best work on watchmaking?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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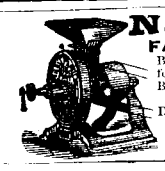

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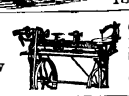

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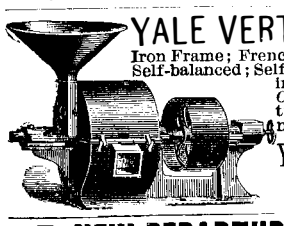

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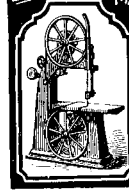

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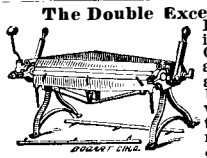

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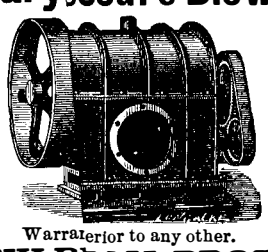

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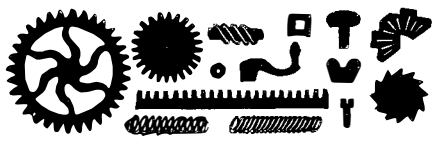

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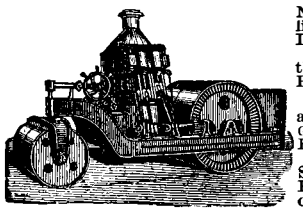

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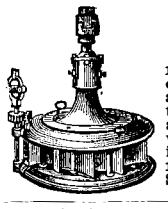

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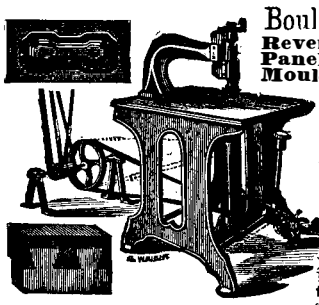

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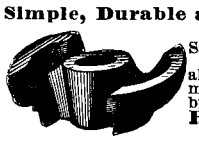

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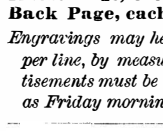

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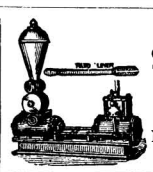
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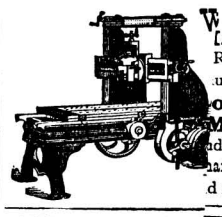
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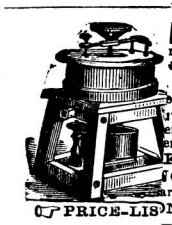
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